THE ELECTRICAL WORLD
A Weekly Review of Current Progress in Electricity and its Practical Applications

PUBLISHED EVERY SATURDAY

AT NO. 9 MURRAY STREET, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

New England Office, 48 Congress Street, Boston.

Philadelphia Office, 1005 Walnut Street.

Western Office, 23 Borden Block, Chicago.

W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.

E P. THOMPSON, Associate Editor Patent Department.

CLARENCE E. STUMP, Business Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.00.

(Postage Prepaid in the U. S. or Canada.)

CLUBS.—In clubs of 4 or more, $2.50 a year each; with a free extra copy to the getter-up of a club of 8. Subscription to foreign countries, $4 a year.

In requesting your address changed, give **old** as well as new address.

THE ELECTRICAL WORLD HAS THE LARGEST CIRCULATION OF ANY ELECTRICAL JOURNAL PUBLISHED, AND IS THE BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions.

Notices of Situations or Help Wanted, $1 to $3 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to

W. J. JOHNSTON, Publisher,

No. 9 Murray Street, New York,

OR ANY OF THE BRANCH OFFICES.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Weston's Current Meter and Energy Meter. 114
Ocean Signal Stations..... 115
Suggestions Respecting the Use of Electricity in Medicine 117
A New Printer..... 119
The Thomas Dynamo..... 119
The Chinnock Current Arrester..... 120
A New Valve Electric Gas-Burner 120

REVIEWS OF NEW BOOKS:
Proceedings of the Seventh Annual Meeting of the National Telephone Exchange Association..... 114

POETRY:
Titwillow..... 121

CORRESPONDENCE:
Closed Circuit Batteries..... 120
Incandescent Lamp Circuit. 120
Arc Lamp Shunt Coil 120
The Dynamo and the Motor. 120

EDITORIAL PARAGRAPHS 113

MISCELLANEOUS:
Buffalo Electrical Society... 114
A Miner's Electric Lamp.... 114
The Telephonic Situation in Indiana 115
A Review of the late Electric Light Convention..... 116
The Electric Light in Mexico..... 117

MISCELLANEOUS: PAGE.
Application of Electricity to Propulsion of Elevated Railroads—(Concluded)... 118
An Early Electric Railway.. 119
A Phenomenon Observed in Arc Lamps with Hollow Positive Carbon..... 119
Telephone Statistics of Europe 120
Features of the New Law Battery 120
The Light in Carriages..... 120
A Scrip Dividend of the Southern New England .. 120
New Officers of the American Electric Manufacturing Company..... 120
The Self-Induction of an Electric Current in Relation to the Nature and Form of its Conductor—(Continued)..... 121

DEPARTMENTS:
New York Notes..... 121
New England Notes..... 121
Philadelphia Notes..... 122
Western Notes..... 122
The Telegraph..... 122
The Telephone..... 122
The Electric Light..... 123
Applications of Power..... 123
Personals..... 123
Miscellaneous Notes 123
Sparks and Flashes..... 124
Stock Quotations..... 124
Business Notices..... 124
Our Illustrated Record of Electrical Patents 124

New Advertisements.

PAGE.
Theo. L. C. Gerry—A New Battery Solution iii
Frenyear & Razee—Sunlight Carbons..... iii
E. W. Hazazer—Bells, Annunciators, etc..... iv
Queen & Co.—Voltmeters, Ammeters, Rheostats, etc..... iv
William J. Keenan—Chromic Acid iv
Jerome Kidder Mfg. Co.—Electro-Medical Apparatus..... iv
Woodhouse & Rawson—Electric Light Engineers, etc..... iv
National Thermostat Fire Alarm Co.—Automatic Fire Alarm v
The Chemical Electric Light & Power Co.—The New Volta Pavia Battery..... v
The Brown Electric Company—Automatic Converter..... vi
Novelty Electric Company—Learners' Novelty Diamond..... vi
C. E. Jones & Bro.—Table of Conductivity and Absorption of E. M. F. of Copper Wire..... vii
Curt W. Meyer—Experimental Apparatus..... vii
Wanted—Position as Manager of Telephone Exchange or Electric Light Station..... vii
Wanted—Position as Electrician..... vii
For Sale—A Galvanometer and Rheostat vii
Esterbrook's Steel Pens..... vii
The Stout-Meadowcroft Co.—The Chinnock Current Arrester..... vii
American Electric Mfg. Co—Debenture Bonds..... vii
T. J. Yost—Catarrh Cure..... viii
Geo. B. Grant—Grant's Gear Book..... viii
Law Telephone Co.—The New Law Prism Battery..... ix
W. I. Harris & Co.—Electric Railways and the Electric Transmission of Power..... ix
American Electric Mfg. Co.—Electric Lighting..... xi
Callender Insulating and Waterproofing Co.—Callender Cables xii
Consolidated Telephone Co—Mechanical Telephones xii

Vol. VII. NEW YORK, MARCH 13, 1886. No. 11.

FOR the present, matters are very quiet with the New York Underground Commission, but the public is reassured at learning that the Commissioners are determined to settle the matter, even if it takes ten years.

THE review by Dr. Otto A. Moses in this issue, of the proceedings of the National Electric Light Association at Baltimore, will serve to refresh the memory of our readers and to suggest new lines of thought and work.

IT is not long since we commented on the remarkable fact that Kansas City had more telephones than London. From an item in this issue it appears that the growing Western city not only has the telephones but uses them "for all they are worth."

WE cannot but approve the policy adopted by the Central Union Telephone Company in meeting the low-rate legislation in Indiana. There is no reason why the company should do business at a loss. We hope soon to see a repeal of the law that banishes the telephone from one of the most prosperous States of the Union.

IT is evident that great interest is felt just now in the subject of lighting from primary batteries, as well as running small motors by the same means. Our own columns have lately recorded several efforts in this line, and now one company, encouraged by the results of its tests, has equipped a large factory in Boston to make its solution and battery, and is ready to do business on an extensive scale.

WE understand that the Gilbert mutual insurance plan for electric light stations is meeting with great favor from all the local lighting companies. An organization will soon be formed, it is said, under the advice and direction of Mr. Edward Atkinson, of Boston, whose reputation as a statistician and economist is the first in this country; and we should be very glad if he could be induced to assume the management, with offices in Boston. The interest taken in the matter by the local companies everywhere shows that the need felt for some such mutual plan is far greater than had been generally supposed.

OUR columns bear witness just now to increased activity in the departments of electric lighting and electrical transmission of power. One feature of the development is the desire on the part of many gas companies to extend the privileges under their charters so as to include the right to furnish electric lights as well as gas. Provided the gas companies mean honestly to furnish electric light, no one can offer any great objection to their acquiescence in the new condition of things; but if the object be in any case to head off opposition and to prevent the introduction of electric lighting, it becomes the duty and policy of electric lighting men to see that opportunities are not thus snatched from them.

IN the March *North American Review* Mr. Cyrus Field sets forth again his well-known opinions in favor of a purchase of telegraph lines by the Government. His idea is that the companies that pay five per cent. annual dividends shall be bought out at par, four per cent. at 80, three per cent. at 60, and so on, issuing bonds at three per cent. to raise the money. "Under this arrangement the United States Government would, in much less than fifty years, own all the telegraph lines in the country, and actually without cost to the Government or people." This means, for one thing, that the Western Union property ought to be bought at its present watered figure and not at a valuation. Should the lines ever be bought, the compensation will not take the shape desired by Mr. Field without tremendous lobbying and vast bribery.

THE question of establishing combined lightships and telegraph stations at given intervals across the Atlantic has received considerable attention in this country as well as abroad. We present to our readers this week the plan of Mr. F. A. Cloudman, who has devoted a number of years to its development, and who is encouraged by the favorable opinions of many experts. Aside from its primary object, such a system would be a valuable addition to the meteorological work which is now carried on with very good results, and would thus make an international weather bureau possible. The safety and speed with which ships could then cross the ocean would, as we have already pointed out, greatly overbalance the cost of maintaining such a system, and we believe that being brought to the attention of the proper authorities, it will receive the consideration which it deserves.

OUR pages contain this week an article descriptive of a new printer that seems likely to find favor with merchants, bankers and others doing a business that requires them to be in frequent and immediate communication with others in the same city or at distant points. It not only can be worked by any clerk or employé unacquainted with telegraphy, but it makes a record of the matter transmitted, so that errors can be corrected at the time, and the sheet can be subsequently referred to should occasion arise. A leading feature is that it is proposed to use the printer in connection with an exchange system, thus enabling the subscribers to any number to have direct intercourse and to preserve the record of their conversation and transactions. This should furnish a great convenience that many would be willing to pay for liberally.

THE article in another column giving the telephone statistics of Europe presents a good subject for comparison and discussion. Why, it may be asked, is there such an enormous difference between the growth of the telephone here and its growth abroad? Under the "fostering control" of the foreign governments, in most cases, the rates are comparatively low, but still judging from our standpoint the peoples of Europe as well as the rulers seem to be slow to see the advantages of the telephone. If we look further, however, we may discern a fact which will account for much. We refer to the lack of exchanges in smaller cities. Thus, in Germany, there are only two exchanges in cities having less than 50,000 inhabitants, and in France only four. Of course, there can be no great use of telephones without exchanges. Evidently the inhabitants of those countries need the enterprising genius of some one similar to Mr. Theo. N. Vail.

THE following might be intended as a dig at electric lighting, but it hardly serves the purpose: "The deliberations of the recent Electric Light Convention, held in Baltimore, were conducted in a room brilliantly illuminated by fifty-cent water gas." It is unfortunately true that the room in the hotel where the meeting was held was not lighted by electricity. Had it been, the meeting would have been far more enjoyable. Anything less comfortable than the heat and stuffiness caused by that fifty-cent gas it would be hard to imagine. The large room was at no time overcrowded, but its atmosphere was unpleasant throughout, as one little incident will show. While reading a brief paper, Mr. Frank Ridlon was so overcome by the heat that the perspiration trickled from his forehead into his eyes, and prevented him from reading. He had, therefore, to deliver nearly the whole of his paper from memory. Other speakers suffered, though perhaps in a less degree, and may be excused for having no very kindly feeling towards that water—or perspiration—gas.

WE would draw special attention to our article describing Mr. Weston's measuring instruments, as they embody a principle which promises to be exceedingly fruitful in results. We have often remarked that nearly every electrical phenomenon might be made the basis of a current indicator, but the movement of a conductor through a uniform field is one peculiarly adapted to the conditions of a simple electric meter of wide range and accuracy. A "direct reading" meter, such as the one described, will go far toward making electric lighting from central stations popular, as it will indicate to the consumer at all times the quantity of current consumed, and for which a bill will be rendered. At the same time such a "light meter" will be a meter in the true sense of the word, and, unlike the gas meter, will not only measure the quantity but also the quality of the light-producing medium. The gas meter evidently takes no account whether the gas passing through it be of 15 or 30 candle-power, but with the form of electric meter we illustrate, the true light-giving value or energy of the current will be measured and continuously recorded.

OUR esteemed contemporary, the *Progressive Age*, accuses us of willful misrepresentation because it was said recently in these columns that the *Age*, on this side of the Atlantic, and *Gas and Water* on the other, had "both practically admitted the superiority of the electric light over gas." The *Age* admits that it said "the arc system is the best means of street lighting," but does not wish to be understood as going any further. If we misrepresented, it certainly was not willful, and we gladly give the disclaimer of the *Age* publicity as above. We still think that the papers *together* gave the palm to the electric light, and that what one of our contemporaries failed to admit, the other acknowledged supplementarily. It was a case of concurrent and reinforcing testimony. We meant to poke no finger of scorn at gas or gas interests, and see no need to do so, being content to let the superior all-round merits of both kinds of electric light rest on the results of scientific test. At the same time, we are sorry that the *Age* should feel aggrieved, since it has, as it claims, always shown a very friendly feeling towards electric lighting, and is now advocating earnestly the installation of electric light plants by gas companies.

THE articles on winding of field magnets for dynamos, which Mr. Carl Hering is now contributing to our columns, call to mind a discussion that has been going on for some time with regard to the results which can be obtained with a given amount of wire both on the magnets and on the armature. While it is evident that, for economy, the least wire possible is necessary, some advocate that this saving of wire to obtain a great "efficiency per pound of copper" should not be particularly striven for, and that in judging a machine this factor should not enter. Aside from the commercial aspect of the question, we fail to see why this argument should be accepted without modification. It is, of course, understood that the weight of wire ought not to be decreased to the detriment of the working qualities of the machine, but evidently every useless inch of wire means additional resistance and a loss. On the other hand, every increase of section means reduced resistance, freedom from heating, etc., but at the expense of increased weight and to the detriment of "efficiency per pound of copper." It has come to be generally recognized, we believe, that the reduction of copper can be effected by an increase of iron in the machine, since to magnetize a large mass of iron at a point removed from that of saturation requires less energy than that of a small mass near the point of saturation. The dynamo of the future will probably be a heavy machine in which the proportion of iron to copper will be greater than at present.

REVIEWS OF NEW BOOKS.

PROCEEDINGS OF THE SEVENTH ANNUAL MEETING OF THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION. Held at Providence, R. I., Sept. 8, 9 and 10, 1885. Published at the office of the Secretary, New York City. 189 p., 8 vo.

The work of this association last September, which was reported in our columns at the time, is of genuine value, and it is evident that as time passes, the influence of the body will be felt more and more. The contents of the work are the papers and discussions of the last meeting, among which the paper on "Exchange Statistics," by Mr. B. E. Sunny, of Chicago, ranks prominently. The book contains the New English wire gauge table adopted by the telephone fraternity, and which we published at the time. Gen. C. H. Barney deserves credit for the excellent appearance of the book, and the intelligent care bestowed upon its arrangement. Telephone publications are quite rare, and we must accord to this one the palm for the year 1885, containing as it does original papers and practical debates of more than ordinary interest.

Weston's Current Meter and Energy Meter.

In 1824 Arago made his well-known experiment of causing a rapidly rotating disc of copper to induce a similar motion in a magnet placed above and parallel with it. He went so far even as to reverse the experiment, and effected the rotation of the disc by revolving the magnet. The explanation which he gave for this phenomenon was not satisfactory, and not until Faraday took up the subject was the true nature of the forces at work revealed. Faraday, however, went further than Arago, and recognizing the fact that the motion produced was due to induced electric currents, proceeded in 1831 to produce a current generator, or magneto-electric machine, upon this principle. The apparatus took the form of a copper disc rotating between the poles of an electro-magnet, the current being taken off at the axis and at the circumference of the disc. Faraday at that time did not recognize the fact of the reversibility of the machine he had constructed; but in the light of our present knowledge it is evident that if a current be sent through the disc from an outer source, it will revolve, or in other words, become a motor.

It is upon the latter consideration that Mr. Weston has constructed two very ingenious instruments, which, while analogous in principle, are used for different purposes of electrical measurement.

The principle upon which these instruments are based, viz., that of moving a conductor in a uniform field, is, in so far as its application to measuring instruments is concerned, original with Mr. Weston, who already in 1884 had constructed instruments on this principle, and from which the ones illustrated have been developed. Ferranti, in England, has constructed a meter in which this principle is employed, but, as stated above, Mr. Weston antedates him.

The first of these, the current meter, is shown in Fig. 1 in perspective, Fig. 2 being a section through the pole-pieces. The instrument is essentially an electro-motor having a disc armature, but the motion of which is prevented by opposing springs. The field magnets employed are similar to those in machines with consequent poles, and the pole-pieces are extended toward each other and brought close to the disc *A*, as shown in Fig. 2. The disc, as will be seen, is centred upon a copper rod *E*, which passes through cores in the pole-pieces and is supported at its upper end by a double-spiral spring *S*, attached to the bracket *F*. The lower end of the rod *E* is enlarged so as to form an inverted cup, which carries within it a cork *K*. It dips into a trough of mercury, which forms an electrical connection

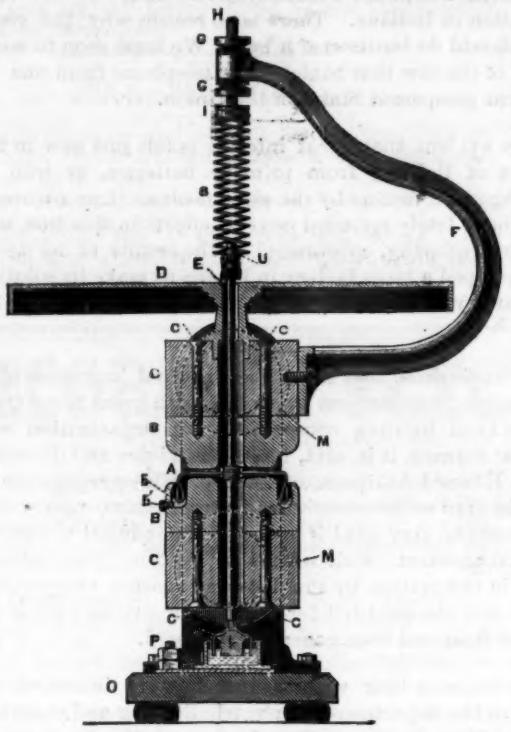


FIG. 2.—WESTON CURRENT METER—SECTION.

for the copper rod, the cork acting as a float to relieve the spring of considerable weight. The outer edge of the disc *A* is bent downward, and dips into a circular trough of mercury *b*, formed in the lower pole-piece. A small screw *b'* acts as a binding-post; the lower mercury trough *L*, mounted upon the base, being also connected with a binding-post, as shown in Fig. 1. We must also add that the upper end of the screw carrying the springs is insulated from the bracket.

With this much by way of explanation, it becomes clear that a current led into the lower mercury trough will pass up the rod, flow through the disc, and pass out through the upper mercury trough and binding screw. The disc being placed between powerful magnets, and having a current flowing through it, will naturally tend to revolve in accordance with the well-known law. Its motion is prevented, however, by the springs, which undergo a torsion proportional to the strength of the magnetic moment between the disc and armature. The stronger the current passing through the disc, the greater will be its tendency to revolve, and hence to distort the spring. The latter, as will be seen in Fig. 1, has a pointer attached to it which passes over a graduated scale, and in this way the deflections of the spring are noted.

While the instrument just described measures the current only, the one shown in Fig. 3 measures continuously the energy passing through the circuit, or, in other words, the volt-ampères, and thus constitutes an electric meter. The principle upon which it is constructed is the same as that of the current meter, but instead of the motion of the disc being opposed by a spring, it is allowed free play and thus acts as a true motor. The spring, as will be seen, is replaced by a recording train upon which the number of revolutions are registered. The field magnets of high resistance are placed in independent circuit with the leads, and the strength of the magnets is thus proportional to the potential of the circuit. The full current, however, passes through the disc in the manner described above. Evidently the speed at which the disc revolves is proportional to the strength of the current in the disc and to the strength of the magnetic field. Thus the speed of the disc is a true measure of the energy in the circuit, indicating simultaneously the potential and current.

It is evident that the capacity of both instruments is practically unlimited, as the current which can be passed through them depends merely upon the size of the spindle and revolving disc. This is a great advantage, as it enables the instruments to be adapted for widely differing services and with equal accuracy.

FIG. 1.—WESTON CURRENT METER.

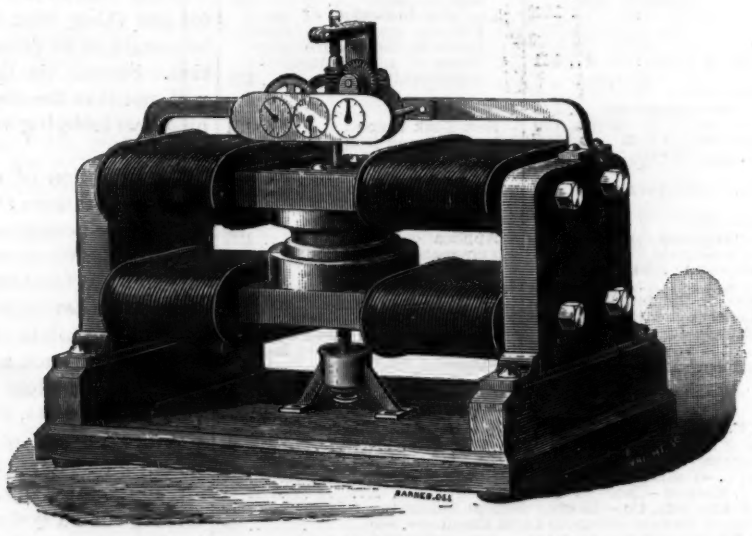


FIG. 3.—WESTON ENERGY METER.

Buffalo Electrical Society.

At the opening of the last meeting of this society President Kitton took occasion to comment upon the interest manifested by outsiders in the proceedings of the society, as shown by the number of applications for membership which had of late been made. He was sure that there were dozens of persons in Buffalo more or less interested in electrical matters who would be glad to avail themselves of the advantages of membership, if such advantages were brought directly to their notice. It was by no means intended to confine the lectures and discussions to matters pertaining to telegraphy only. Telephony, electric lighting and the application of electricity in all its various branches were subjects which would, in due course, come up for consideration.

A communication from the National Telephone Exchange Association on the subject of a "standard wire gauge" was next considered, and the following resolution was unanimously adopted:

"That this society, recognizing the desirability of securing a uniform wire gauge, cordially support the endeavors of the National Telephone Exchange Association to bring about the universal adoption of the new English standard wire gauge as being the best adapted for all electrical purposes."

The remaining formal business having been disposed of, S. T. Davidson, traffic chief of the Western Union, proceeded to deliver a lecture on the quadruplex system and the application of the condenser to multiplex telegraphy.

A Miner's Electric Lamp.

At the recent conference of the Miners' Union, in England, Mr. Burt, M. P., the president, observed that two things were very desirable in the way of lessening the number of explosions. One was the provision of a good, useful light, and the other the abolition of blasting by gunpowder in fiery mines. We read in the London *Times* that the first of these conditions appears to be met by an apparatus which is self-contained and consi ts of a chloride of silver battery composed of three cells, each 6 in. high by 3 in. wide and 1 in. deep. The current produced supplies a small glow lamp, of German manufacture, which is placed in front of the metallic case containing the battery after the fashion of the bull's-eye of a police lantern. The lamp is well protected, and is provided with a reflector, so that a good light is thrown forwards. The light given by this lamp is stated to be of 3 candle-power, and to be capable of burning for nine hours, but this, as far as candle-power goes, is in excess of the requirement of the miner, so that smaller sizes are made. The cells are hermetically sealed, so that the lamp can be used at any angle without fear of loss of the liquid or extinction of the light as with the ordinary miners' oil lamp, than which the new one is said to cost much less for maintenance. Upon this point, remarks our contemporary, it is to be observed that when the power of the cells is exhausted there is no waste of the elements. The chloride of silver will have become converted into pure silver, and can be revivified by washing in a solution of nitric and hydrochloric acid. The lamp and the battery are both locked against the miner, who cannot interfere with either. The lamp can be hooked up in the ordinary way, or attached to the miner's belt. It has, says the paper, had the approval of one of the leading electricians, and of several mining authorities, subject to being tested.

The Telephonic Situation in Indiana.

On March 2 the Central Union Telephone Company, Chicago, issued the following notice to its patrons in Indiana; "This company announces with regret that, in view of the recent decision of the Supreme Court of Indiana sustaining the validity of the law regulating telephone rentals and toll line charges, it has voted to decline all new business in the larger cities, where it is impossible to furnish service under the law without loss; to forthwith give notice of the termination at the earliest possible date of the contracts of all subscribers in such places; to make the continuance of exchange business in smaller places dependent on the possibility of continuing under the law without loss, and to appeal to the Supreme Court of the United States. This conclusion has been reached after a careful and thorough revision of the estimates which were submitted to the committee of the Senate and the Governor of the State, and upon which the oaths of its officers in pending litigation were based, showing that the company could not profitably carry on its business under the present law. Much time has been spent in an effort to devise some plan by which all of its exchanges and toll lines could be continued, but to no purpose. In conclusion, the company desires to express to all of its subscribers its thanks for their patronage, and especially to the majority who have felt, in common with its officers, the inexpediency and injustice of the law."

Superintendent Hockett has received notice from the Executive Committee of the company to decline all orders for the putting in of telephones until further notice, and also to close several toll stations, as they could not be made to pay expenses under the new law. The notice of the Telephone Company's intentions to discontinue business was mailed to every subscriber in the State, and it will be followed by a formal legal notice of the termination of the contracts with such subscribers as signed the agreement, making only fifteen days' notice necessary. The company says it must take the telephone out in the State, to put an end to the passage of laws in other States.

Of the 1,000 instruments in Indianapolis, the agreement in the case of 500 of them can be terminated in fifteen days. The remaining 500 subscribers, more or less, have contracts which will be terminated at different dates, according to their provisions, the date of termination being in every case the earliest possible under that particular contract. The company's private line business will be continued, its charge for instruments for that purpose having always been within the limit prescribed by law. Inquiry being made as to how and where the line is to be drawn so as to include the "larger cities, where it is impossible to furnish the service under the law without loss," it was learned that this was to be determined by a very careful examination of the accounts, which is now in progress, but that it certainly means Indianapolis and Terre Haute, and probably Lafayette and some other places. It was also learned that the phrase, "To make the continuation of the exchange business in smaller places dependent upon the possibility of continuing under the laws without loss," means exactly what it says. Neither a very large exchange nor a very small exchange, it is claimed, can be operated at the legal rate, and a careful examination of the accounts alone can determine where the line will be drawn.

Ocean Signal Stations.

The plan for a system of ocean signal stations, relief and lightships, as presented to our readers in this issue, is from its original design, as submitted to General Myer, Chief Signal Officer of the United States in 1874.

This plan presented the first practicable means for the collation and distribution of accurate meteorological data from the North Atlantic Ocean, the first feasible plan providing instant communication between a ship in mid-ocean and the mainland, and the first system devised to aid distressed mariners, and enabling them to make known their condition and position, that had been brought to public notice. Since that time several plans, calculated to achieve the same results, have been pushed forward by British engineers, the most prominent of which are the systems as designed by C. E. Anderson, of Leeds, 1882; Charles W. Harding, of London, 1883, and the more recent one of Captain Moody, R. E., of Barrow-in-Furness, in 1884.

These later plans seem to present no new desirable features in point of construction, and it is not claimed that they will confer any additional benefit to science, commerce, or agriculture, beyond those presented by the original American plan herein described.

The system embodies the construction of the stations which are to be moored at certain intervals between America and Europe, and between the United States and China via the Sandwich Islands, and the laying of a telegraph cable between the continents, which is to be connected with each of the stations and also with the telegraph systems of Europe, Asia and America.

In accordance with the plan, the station is to be a circular vessel (Figs. 1 and 2), of about 50 feet beam, with a depth of hold of 70 feet, strongly built of the best materials known. A convex top, having a pitch of 30 degrees, sustains a tubular iron framework, at the top of which, at a distance of 75 feet from the deck, is to be placed the lantern and lighting apparatus, a Fresnel lens of the first order and an electric arc light, forming a beacon that can be seen at a great distance. For signaling in thick or foggy weather, the powerful steam siren invented by Prof. Helmholtz, the well-known Prussian physicist, has been adopted. This instrument produces a sound that in calm weather can be heard at a distance of 30 miles and is considered the most perfect fog signal ever invented. The skeleton framework presents the least possible surface of resistance to either wind or sea, and consequently reduces the liability of severe strain upon the hull of the station to a minimum. The portion of the vessel above the water is intended to be armored, and being circular in shape, with a convex deck, it offers no point of resistance to the sea, which might sweep with all its relentless fury without causing the slightest damage to the station or its occupants.

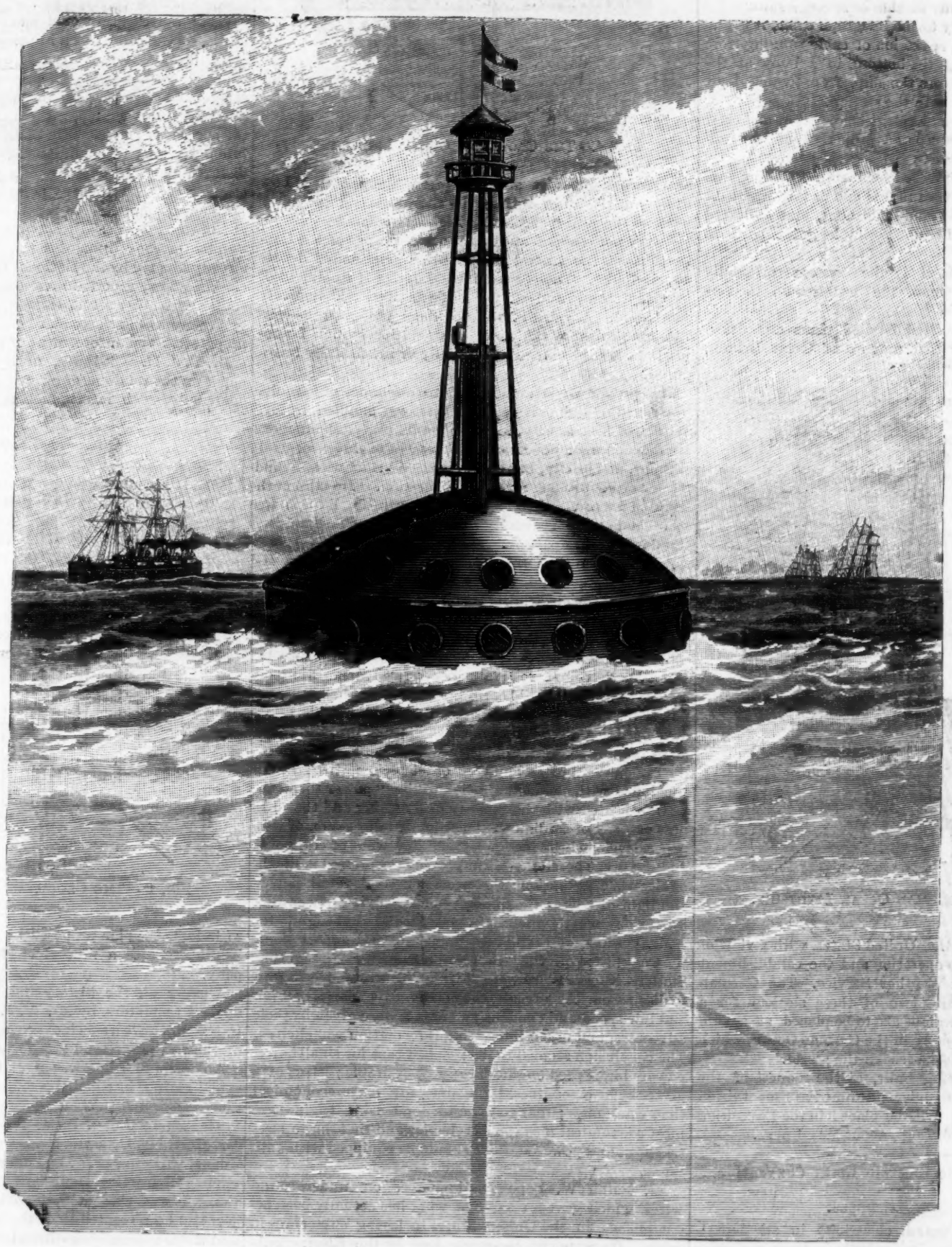


FIG. 1.—THE CLOUDMAN OCEAN LIGHTSHIP AND SIGNAL STATION.

Particular attention has been paid to the ventilation of the stations. Two of the tubular columns mentioned will contain powerful fanlike wheels driven by power derived from the machinery below, one of these supplying pure, fresh air in abundance, while the other exhausts all the foul air and gases that may accumulate below the decks. Conduits from each of these ventilating shafts extend to every room or compartment in the hull. The fans are calculated to furnish over 7,500 cubic feet of air per minute—a quantity more than sufficient for all necessities. The remainder of the tubular columns are to be used as steam-pipes, smoke-stacks, etc., one of them being used as a stairway to the lookout room situated just beneath the lantern.

The station will be submerged to a depth sufficient to establish and maintain an equilibrium as nearly perfect as is possible. For regulating the submersion, two large tanks, extending entirely around the interior of the lower hold and capable of holding many hundred tons of seawater will be placed, so that the ability to rise above or sink below the level of the sea will always be under the control of the commander of the station.

As to the safety of these stations, it is admitted by naval experts that this form of station has fine sea service qualities, and would beyond doubt safely ride out the fiercest North Atlantic gale or an East India typhoon. The fact of its being so nearly submerged and presenting no sharp points of contact, renders it unlikely and impossible that they could ever encounter any severe strain. The motion of the station in heavy weather will be slow and easy, and with absolutely no strain upon either hull or mooring

cable. The interior of the station is divided into several decks or holds similar to ordinary vessels, these again being divided into cabins, scientific and operating rooms, electrical machinery and engine rooms, etc. (Figs. 3 and 4). In the lower hold the boilers, coal bunkers and ballast tanks will be placed.

The interior will be lighted throughout by the incandescent system of electric lighting in addition to "deadlights" on the main deck. For mooring in the great depths of the oceans a light steel cable of small diameter is to be used in connection with a peculiar form of anchor known as the mushroom anchor. The peculiar form and therefore great buoyancy of these stations renders it possible to sustain the immense weight of the single mooring cable. The extreme length of cable necessary to reach the bottom of the ocean—in some locations a depth of 2,700 fathoms—obviates the necessity for more than one cable, which at the same time acts as a drag and relieves both vessel and anchor from any sudden or severe strain.

In order to avoid injury to the telegraph cable, it is proposed to use a secondary or section of cable running from the main cable, resting on the bottom, to a buoy at the surface a short distance from the ship, from which buoy connection will be made with the station.

A corps of observers, meteorologists, operators and crew sufficient to completely equip and properly man the stations will be attached to each.

The stations will be numbered for identification by day, carry distinguishing lights at night; and as they are to be located in known latitudes and longitudes, and indicated on all charts, they will become veritable guide posts to the mariner.

The plan above outlined is the system originally designed by F. A. Cloudman, the well-known meteorologist of Rondout, N. Y.

Mr. Cloudman has submitted detailed plans and drawings of the system to the governments of Great Britain,

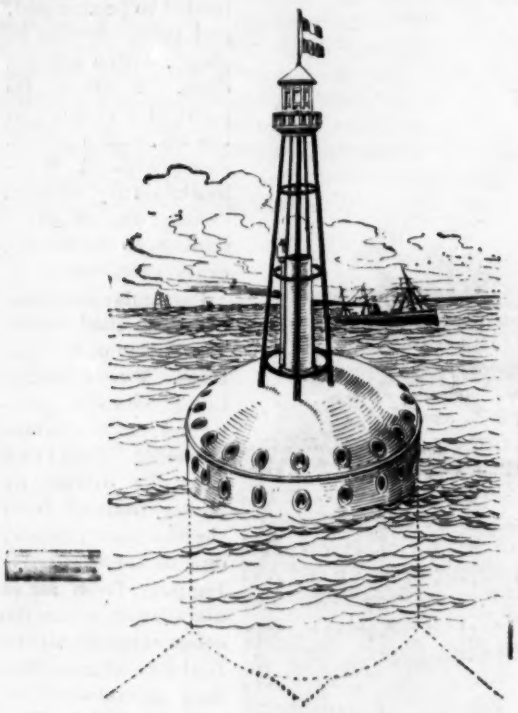


FIG. 2.—THE CLOUDMAN OCEAN LIGHTSHIP.

France, Germany and the United States, with a view of securing international co-operation and the establishment of a Universal Signal or Weather Service. The German government is now building two of these stations for a trial test. These test stations are to be placed at a considerable distance from shore in the German Ocean, which is one of the most boisterous seas in the world.

A small model is being built, at the request of the Trinity Board of London, under the immediate supervision of the designer, and it will be placed in the Exposition which opens at Liverpool, Eng., about May 1 next.

A Review of the Late Electric Light Convention.

BY DR. OTTO A. MOSES.

When properly considered, electricity in all departments is but one science. Its growth is from one root, whose fibres are the facts that observation and study have discovered, and whose juices indiscriminately feed the two grand trunks of theory and practice. These rise aloft, side by side, parallel at first, then their branches finally intertwine into one harmonious growth, and unite in the production of one perfected fruit.

The recent annual meeting of the National Electric Light Association in Baltimore gives abundant evidence of this collateral growth. It proves how essential to the success of electric lighting is the proper interchange of views between scientific and practical men, who are engaged in the study of the subject. The wants of the practical man are the healthiest food for thought to the man of science, who should select those topics for study and development which may tend to remove obstructions from the paths of practice. The practical man is the pioneer, and bears the brunt of battle. The man of science, from a distant or more elevated position above the smoke of the fight, should carefully scan the field, in order to send new forces to the point that needs them most, or to provide methods of escape for the bewildered.

The discussions, printed in the full reports of the proceedings, show how much has been done to advance electric lighting since the last meeting in New York, and prove that the interchange of opinions there has produced abundant results. A larger attendance of members and applicants for membership; the presence of a considerable body of scientific men, and strong delegations from the

FIG. 4.—THE CLOUDMAN OCEAN LIGHTSHIP.

insurance companies and the press demonstrated how lively was the interest taken by the whole country in the work of the National Electric Light Association.

A very noticeable feature in the proceedings of the Convention was the general participation in animated debate on all topics. There was a wide range of treatment of electric lighting, and all the subjects were exhaustively considered. A spirit of thoroughness possessed the convention, proven by the mere enumeration (which I subjoin) of the subjects either specially or incidentally introduced.

The proper construction and maintenance of circuits (restricted to aërial arc light circuits) was handled by Mr. Weeks, of Kansas City, in a thoroughly practical manner. He touched upon details of management of large central stations, and briefly, but clearly, stated his views as to the necessary conditions for their operation. He also contributed a second valuable paper on "Operating Expenses," whose data were frequently referred to in the debates as standards of comparison.

A paper from the Committee on "Electricity as an Illuminant" was read by myself, in which the periodic advances of the electric light were indicated. A coming period was predicted as one likely to produce a great and sudden increase in the uses of electricity for light and other purposes.

Mr. A. F. Upton read a paper on "Transmission of Power by Electricity," bearing especially on the letting of power for manufacturing purposes, more particularly as developed at the Edison Company's station in Lawrence, Mass., and by the Daft Company in Boston. He mentioned the difficulties and advantages of electric railways, and concluded with eloquent allusion to the "power that can be transmitted with the rapidity of lightning and the stillness of a ray of sunlight." An animated discussion of this paper developed the incompleteness and want of economy, and the great possibility of improving the present methods of electric distribution; the necessity to dovetail power and light districts; the difficulty of supplying power during the day where much light was furnished at night, etc.

Mr. Fosdick, of Fitchburg, made an oral report from the Committee on the "Best Equipments for Arc Lighting Stations, Steam Power, etc.," which was intended to lead to discussion. As a result, the comparative merits of high and low speed and condensing engines were given by their advocates, and much interesting information was elicited. The conclusion seemed to be reached that for small horse-powers high-speed engines are most desirable; that, of a given class of engines, large ones are more economical than small ones; that compound condensing engines are most economical if water be cheap; and that large electric light and power stations should be equipped with both kinds.

Mr. Ralph W. Pope read a paper on underground wires, which gave a résumé of what has actually been accomplished in the United States in laying subterranean wires. He reviewed the work done by the Electric Subway Commission of New York, and various plans of more or less merit submitted to them. He also stated the essential precautions to be observed in placing wires carrying currents of enormously different quantity and potentials.

This topic was of greatest importance, on account of the probable action of municipal governments compelling owners of aërial lines to conceal them. The President of the Convention, Mr. Morrison, of Baltimore, from the floor led discussion on this vital subject, which was generally engaged in. He admitted that combined science and art had rendered it possible to bury the wires, but economic questions stood as a bar in the way. A forcible resolution, by Mr. Cooper, of Brooklyn, was adopted, in which it was emphatically declared inexpedient and unjust to force electric light companies to adopt any underground system which had not ceased to be experimental; and, further, expressing the sense of the Association to be that no legislation looking to the placing of wires under ground should be enforced.

The ill effect of hasty and arbitrary legislation in England is too recent, and the partial paralysis of electric lighting interests in that country too apparent, for our authorities to imitate them blindly. Deliberation is required before any subterranean system be legally supported. The actual conditions governing distributions of current in each town should be allowed to prevail in local legislation; and then great latitude should be permitted in continuing the methods already adopted and in vogue.

Lighting from primary batteries was treated by Mr. Allan V. Garratt in a conservative way. The progress of manufacture in an essential chemical (I presume either the bichromate of soda or chromic acid) was said to be the cause which would render certain batteries available for incandescent lighting in places where the dynamo, as a source of power, could not find entrance, as in a yacht, a man's private carriage, etc.

What a treasure would such an arrangement as this have been to a Pliny or a Napoleon!

Mr. Frank Ridlon read a paper on "Carbons and Globes" containing very practical suggestions, among others, as to the necessity for using carbons of equal conductivity for equal lengths in a given circuit. Nearly all the success of electric light plant depends upon the absolute uniformity of conditions affecting the elements, the disturbance of any one of which would produce a varying electromotive force at any point of consumption. A committee was appointed to report on the subject. Another committee was specially appointed to consider the adoption by the convention of the new standard English gauge, already adopted by the National Telephone Exchange Association. They reported favorably, and were instructed to confer with other associations with a view to the legalizing by Congress of such standard gauge for guidance in the preparation and enforcement of contracts.

Mr. C. J. H. Woodbury, of Boston, read a suggestive paper on the relations of electric light to insurance, which contributed such information as induced the association

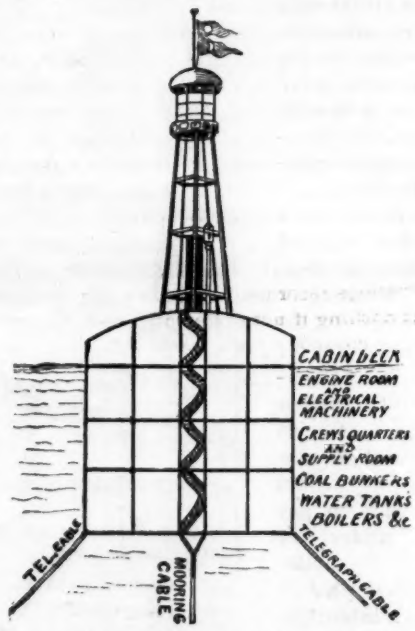


FIG. 3.—THE CLOUDMAN OCEAN LIGHTSHIP.

to indorse the plan proposed by Messrs. Gilbert and English to organize a mutual electric light insurance company.

A paper on the history and progress of electricity as applied to motors, by Mr. W. J. Johnston (read by Mr. T. C. Martin), gave a succinct account up to the latest moment of the vast progress in this department.

An entire morning was given to discussion of incandescent lighting, in which Prof. Rowland, of Johns Hopkins University; Dr. Duncan, of the Franklin Institute Committee on Testing of Incandescent Lamps; Mr. Morrison, Mr. Kerr, Mr. DeCamp, Mr. Cooper, Mr. Smith, and many others, participated. This interesting and lively debate elicited many facts, both new and useful to the convention. It was evident that an intense interest in the subject had been created since the last meeting in New York; and it was generally admitted that the use of incandescent light on arc-light circuits was becoming a necessity, and the general hope was expressed that they would soon be successfully and universally introduced in happy combination.

A history of electric lighting, by Mr. J. W. Beane (read by Mr. R. W. Ryan), contained a very interesting review that could not but be stimulative to those who heard it, and who themselves were helping to contribute another volume to the records of progress in this age of electricity.

Electric Railways.—A short book on this subject has just been written by Robert Luce, A.M., and published in Boston.

Western Union Taxes.—After many objections and long delays, the Western Union Company has paid the tax in this State on its capital stock.

Suggestions Respecting the Use of Electricity in Medicine.

An excellent little volume by Ambrose L. Ranney, M. D., has just been published,* giving a comprehensive review of the important department of electro-therapeutics and electro-diagnosis. The electrical treatment of to-day in medicine has risen to such a high standard, especially in mental diseases, that no physician can be considered well equipped without a thorough knowledge of the effects of and the proper methods for applying the electric current. Dr. Ranney, whom we have often quoted in our columns, has made this study a specialty, and his book, which is the forerunner of a large, and more elaborate volume on the subject, is a reprint of a series of lectures delivered to the students of the Medical Department of the University of Vermont. It contains all the salient points in this growing method of treatment. That medical electricity has developed into an exact science is no longer open to doubt. As the author says, much of the neurological literature we now possess is materially lessened in value by the fact that the observations recorded lack scientific precision. Dr. Ranney is nothing if not systematic, and he immediately sets about to construct an apparatus by which scientific precision can be attained. The illustration, Fig. 1, shows the method he employs in diagnosing the facial, ulnar and musculo-spiral nerves of each side. He sits before a key board and notes the results of his observations, which he can vary at will. To add to convenience, Dr. Ranney has also devised the physician's cabinet shown in Fig. 2, which has been constructed for him by Messrs. Waite & Bartlett, of this city. The instrument has for continuous current, or galvanic treatment, forty cells of Leclanché "disque" battery, set up in the lower part of the cabinet, where they are very accessible. It also contains, for operating the Faradic or induction-part of the apparatus, two cells of powerful elements, which need only occasional attention. To the polished rubber base, in the upper part of the cabinet case, are attached the current selector, automatic vibrator, measuring galvanometer, a wire rheostat, and a pole-changer.

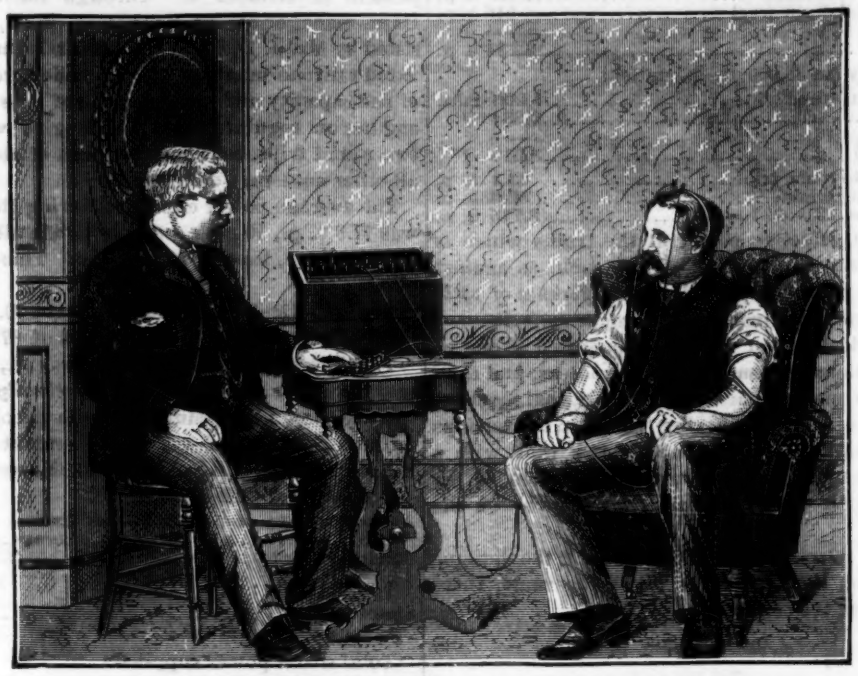


FIG. 1.—METHOD OF ELECTRICAL DIAGNOSING.

With this apparatus the physician is well fitted out for his work.

Dr. Ranney passes in review all the various methods and applications; and the numerous illustrations and plates make the text very clear. For those interested in electro-medical applications, the book will prove extremely interesting and useful.

* "Electricity in Medicine," D. Appleton & Co. 12mo, 147 pp. Price $1.

The Electric Light in Mexico.

The City of Mexico correspondent of the Boston *Herald* sends his paper an interesting account of electric lighting in Mexico, where it would appear that the new illuminant has a great future before it. There are at present, he says, at the capital, 60 Brush lights in the city circuit, and they are excellent illuminators, making the main avenues of travel brilliant after nightfall, and serving for the protection of the belated pedestrian better than a squad of mounted police. The power for these lights is derived from wood, which costs the Gas and Electric Light Company $12 per cord. At present rates coal brought via the Central Railway costs $21.25 to $22 per ton, making it altogether too expensive for use in securing power for electric lighting. Year by year the pine grows scarcer, and the woodcutters have to go further away from the city for their supply. In 1868, when the gas company first began there, wood could be bought for $8 per cord.

The use of gas is quite general in the richer class of houses, though the rate is something fearful to contemplate—$7.50 per thousand feet, or about $6 American gold. The city is supplied at $5.50 per thousand for street lighting. As may be imagined, gas is used sparingly, and the usual illuminant is kerosene oil from the United States, retailed now at $1 per gallon, or 80 cents American gold. Indeed, all illuminants are very expensive, and form an important part of housekeeping expenses. In the remoter parts of the city the old-fashioned oil lamp is in use, the lamp being swung across the middle of the street by a wire or rope. The oil used is frequently kerosene, often some vegetable oil of dim illuminating power, or turpentine of villainous smell. But gas is employed in the better streets nearer the centre of the town, and, as remarked before, on the main thoroughfares the Brush electric light dazzles the eye.

He continues: "Owing to the extreme rarity of the air at this elevation of nearly 8,000 feet above the sea level, the electric light here surpasses in brilliancy the same light in the streets of Boston or New York. The sun here shines far more dazzlingly than on the sea level, and distant mountains, 70 or 80 miles away, seem not more than 20 miles off. Therefore the electric light is a splendid illuminant here. But, on account of this very rarity of the air, gas is but a dismal affair for illumination.

"Another difficulty in the way of making gas lighting a success, is the fact that laying pipes is something like trying to light Boston harbor with lamps regularly placed. Dig anywhere to the depth of 2½ feet and you strike brackish water, that infiltrates the soil from Lake Texcoco. You might as well lay your pipes in salt water, or endeavor to lay them in the lake itself. The brackish water rusts the pipes out fast, and the gas company's laborers are always at work mending pipes, wading leg deep in mud and water.

"Gas is made here, not from coal, but from resin, which is brought in by the Indians and purchased by the gas company for 43 cents an arroba of 32 pounds, or about 34 cents American gold. This fact explains the costliness of gas manufacture here. The gas made from it is not, I think, of a quality to be compared with that made from coal, and when you recollect that gas at 8000 feet above the sea level has been scientifically demonstrated to have but six-tenths the illuminating power of the same quality at the sea level, you can see why the electric light should be preferred here.

"The contract which the city government is about making, and which, in fact, is substantially completed, contemplates the erection of nine towers, in addition to the one now standing near the Paseo de la Reforma. Every tower is to have four lamps of 4,000 candle power each, giving to each tower an illuminating power of 16,000. In addition, there are to be 600 arc lamps of 2,000 candle power each. That is, this system will be completed in three or four years, when the drainage of the valley will have become an accomplished fact, making this region the sanitary paradise of the continent.

"It is proposed to go ahead slowly and to come to the full system gradually in accordance with the revenue of the city, which is very carefully administered. In the further future it is contemplated to introduce a complete tower system, with a full complement of 80 towers, which would give the city abundant light, and would cost in reality about 25 per cent. more than the present system of electric lights, gas and oil combined. But the city government is not disposed to contract expenses it cannot meet, though I am of the opinion that it would be better for the city to negotiate a loan of $5,000,000 and go on more rapidly with perfecting its drainage, lighting and paving arrangements. This can easily be made a most magnificent capital. It has the picturesqueness of quaint architecture, ancient churches and superb avenues, and only needs a renovation of the features named.

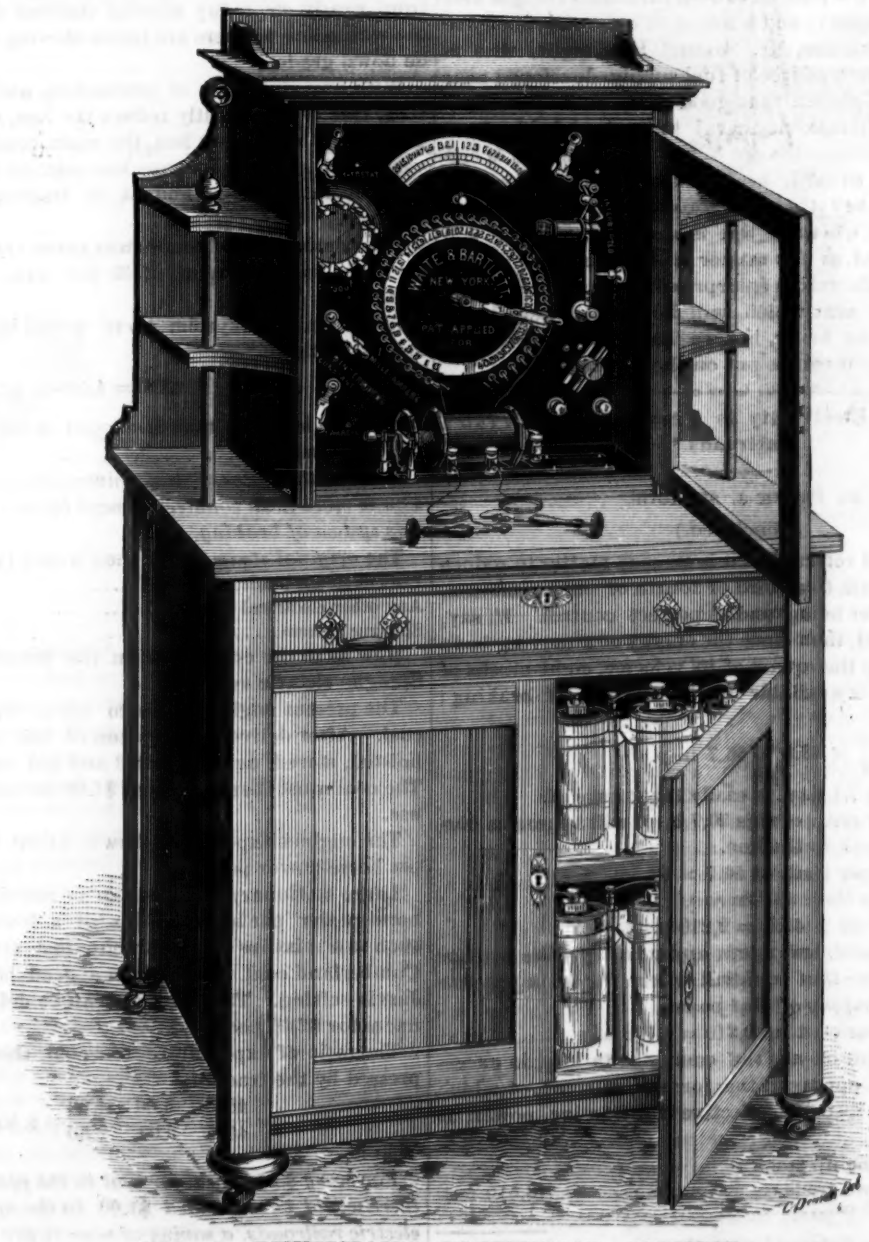


FIG. 2.—PHYSICIAN'S ELECTRICAL CABINET.

"The company which now furnishes the electric lights is, as I have said, the 'Brush,' but it has a lively competitor in the 'Thomson-Houston' of Boston, which is negotiating for the adoption of its system, for which it claims distinct advantages. I know nothing of the merits of the competing companies which will have to arrange

the matter in London, the headquarters of the Mexican Gas and Electric Light Company.

"From what has been said in this letter, it will be seen that the fuel question is a most important one here in considering the subject of electric lighting. It is because coal and wood are so very expensive that incandescent lighting for the interior of houses seems out of the question. It would be a luxury for the very rich only. But I would advise those electric lighting companies which can operate with fair economy to investigate the question of supplying their lights in the hot coast cities where fuel is comparatively cheap, and where lamps and gas are uncomfortable contributors to the heat of already hot apartments. I should think that Vera Cruz, where coal can be had in ballast from New York at about $6 per ton, would be able to make good use of the incandescent system for shops and private houses. Then Mazatlan and Tampico should not be overlooked. This matter is well worth an investigation, and an old Vera Cruzan assures me that it ought to be tried in his city. I cannot see any chance for incandescent lighting here till we get a supply of cheap fuel. Then, too, we do not feel the heat of lamps or gas in our rooms even in mid-summer, for the evenings are invariably cool.

"For two or three years past it has been known here that peat was to be found near Lake Chalco, but not until recently was it a matter of certainty that the supply was practically inexhaustible, and that the bottom of the lake was one vast deposit of this useful fuel. This fact has encouraged a number of Mexican gentlemen, mostly professional men, to subscribe and pay in their money for the formation of a peat fuel company, and machinery for the working of the peat is on its way already from the United States via the Central railway. Another company is likely to be formed soon to work a second peat deposit near the one mentioned. Aside from the fact that peat is near at hand to supply the wants of this capital, it is highly encouraging to note that Mexican men of capital are willing to coöperate for the utilization of this deposit. There is an abundance of capital right here on the spot for all useful undertakings, and if once the Mexicans get to forming stock companies, a great impetus will be given to the development of the national resources.

"Specimens of the peat have been furnished the gas and electric light company, and a test of 10 tons will shortly be made by the manager, Mr. Samuel B. Knight, who is anxious to see a new source of fuel supply developed near the city. If it be shown that good peat can be furnished at a price that will make it a rival to coal and wood, we may yet have the incandescent light. A ton of coal is calculated here to equal in heat-making power three tons of peat, but I fancy that four tons of peat will be found to be nearer right when the test is made, of which I will keep you informed, as this matter is of the utmost importance to all manufacturing enterprises in this region. That we have all the peat which will be needed hereabouts for many years we know, but we have yet to ascertain just how cheaply it can be put on the market."

Application of Electricity to Propulsion of Elevated Railroads.*

BY FRANK J. SPRAGUE.

(Concluded.)

By this method referred to it is an easy matter to reduce the speed of a train to a third or fourth of its maximum, the braking power being under perfect control. If, say, to one-third speed, then since the energy of a moving body is proportional to the square of its velocity, eight-ninths of the train energy is available for the first step of braking; that is—

$$\frac{8}{9} \times 63.8 = 56.7 \text{ h. p.}$$

The remaining 7.1 h. p. is easily taken care of.

At least 75 per cent. of this 56.7 h. p. will appear as current delivered back to the line.

75 per cent. of 56.7 = 42.5 h. p.

In 52 stoppages there will be saved

$$52 \times 42.5 = 2{,}210 \text{ h. p.,}$$

of which 80 per cent. will again appear as effective tractive work on the axles—that is, it will relieve the main generating station of a supply of that power.

80 per cent. of 2,210 = 1,768 h. p.

Also 75 per cent. of all the energy of falling, in excess of traction, will appear in the form of current, of which 80 per cent. will become effective for tractive power, as follows:

We have for the up track:

Lineal distance down grade	16,510 feet.
Stopping at 6 stations	1,734 feet.
Difference = distance for traction	14,776 feet

Traction, $\frac{80 \times 8 \times 14{,}776}{33{,}000}$ =, in 33,000 ft.-lb. units....286 units

Energy of falling	667 "
Excess of energy of falling over traction	381 "
Current energy returned, 75 per cent. of 381	286 "
Effective energy appearing, 80 per cent. of 286	229 "

Down track:

Lineal distance down grade	13,160 ft.
Stopping at 6 stations	1,734 ft.
Difference distance for traction	11,426 ft

Traction, $\frac{80 \times 8 \times 11{,}426}{33{,}000}$ =, in 33,000 ft.-lb. units....221 units

Energy of falling	700 "
Excess of energy of falling over traction	479 "
Current energy returned, 75 per cent. of 479	359 "
Effective work appearing, 80 per cent. of 359	287 "
Total recovered, 229 + 287 =	516 "

There is, then, in this electrical system recovered in effective work and again applied to driving the train, for each round trip as follows:

Stopping, up and down tracks	1,768 h. p.
Down grades, up and down tracks	516 h. p.
Total	2,284 h. p.

We have energy (in 33,000 ft.-lb. units):

Expended for train, round trip	5,903 units.
Net recovery	2,284 "
Net expended	3,619 "
Average per minute round trip	43.1 h. p.
Average per running minute	52.3 h. p.
Total for 63 trains, 63 × 43.1 =	2,715 h. p.

This is the net effective power at the trains which is required to operate 63 trains of 80 tons each, as against 4,640 h. p. in the present steam plant, *a difference of* 1,925 *h. p., or* 41 *per cent., in favor of the Sprague system.*

But the electrical power must be generated at one or more central stations, transmitted to the motors, and then reconverted into mechanical work—the original mechanical work of the engines suffering from two conversions and one transmission. Experience shows that with a good distribution and properly constructed motors, 60 per cent. of the original will appear on effective work on the car axle.

Then for any electrical system not using the Sprague system of braking, but with other losses the same, there will be required at the central station—

$$\frac{100}{60} \times 4{,}429 = 7{,}382 \text{ h. p.}$$

With the Sprague system, nearly every motor coming to a station, or running on a down grade, becomes a generator which is helping to supply the current needed to operate the remaining trains.

The method has already been shown to save about 40 per cent. as against any other electrical system.

Instead of the current being all supplied by the main generating station at one or two points, it is supplied from nearly as many moving stations distributed along the whole line as there are trains slowing down or running on down grades.

With any given size of conductors, and average potentials, this would greatly reduce the loss, or with the same percentage of loss on line, the main conductor would be very much smaller, because less current is supplied from the central station, and it is transmitted a shorter distance.

The relative size of conductors neces-ary would be about as 100 is to 45, a saving of 55 per cent. in favor of this system.

In the Sprague system there would be required at the central stations

$$\frac{100}{60} \times 2{,}715 = 4{,}525 \text{ h. p.;}$$

something less than that developed on the present locomotives, which is.... .....4,640 h. p.

That is, the losses of two conversions and one transmission is more than counterbalanced by the amount saved in this system of braking.

The *original steam power* then would be

Present steam plant	4,640 h. p.
Any other electrical system	7,382 h. p.
Sprague system	4,525 h. p.

Now as to the cost of coal in the present steam and the Sprague electric system:

The present engines have to use a very good grade of coal. After delivery, every ton of this has to be carted, hoisted, stored, again handled and put on to the engines. The coal must then cost about $4.00 per ton when ready for use.

The engines expend, as shown, about 6 lbs. net of coal per horse power per hour.

Large stationary engines can be relied on to develop a horse-power per hour on 3 lbs. of a lower grade of coal, such as a mixture of anthracite dust and bituminous or Cumberland coal, if burned in a good boiler, with, say, a Jarvis setting. This mixture can be delivered to the furnaces for $2.50 per ton.

The ratio of expenditure for coal, then, would be expressed by the fraction:

$$\frac{4640}{4525} \times \frac{6.00}{3.00} \times \frac{4.00}{2.50} = 3.50$$

That is,

For every $3.50 *spent for coal in the present steam plant, there would be expended* $1.00 *in the Sprague system of electric railroads, a saving of over* 71 *per cent.*

Against this and some present labor expenses must be put the cost of running the central stations.

Another consideration which must be taken into account when a part of the energy of the trains is returned to the line, as I have described, is the great saving in the original investment at the central stations as well as in the conductors. In the particular instance here given there is a difference in the power to be provided for at the central stations of 7,382 — 4,525 = 2,860 h. p.

The saving on this would, for lots buildings, boilers, engines, dynamos and fittings, be not less than about $150 per h. p., or $429,000. There would be nearly a proportionate saving in the labor, depreciation, and the incidental expenses of the central station.

Again, since the motor system affords a very perfect system of braking, neither vacuum or pressure brakes need be used, although the hand brakes would, of course, be retained.

As a somewhat remarkable corroboration of theoretical by practical work, I would refer to the account of Mr. Angus Sinclair's work in the *Scientific American Supplement* of October 3. Through the courtesy of Col. Hain, manager of the Manhattan Road, Mr. Sinclair, assisted by Mr. J. D. Campbell, general foreman of the elevated railroad machine shops, made a very thorough test of the capacity and performance of one of the standard engines on regular duty. The engine was indicated for two round trips, that is, over a run of about 34 miles, and all other necessary data taken.

The average power expended during the whole distance was 77.8 h. p., 10 per cent. of which is allowed for friction of the engine, leaving 70 h. p. net. This by actual experiment.

By theoretical determinations I got 70.3 h. p., which includes 5 per cent. friction, or a net of 67 h. p.

The difference is 3 *h. p., or* 4½ *per cent., which may represent the excess of weight of train actually tested.*

Since these nearly similar results are obtained by totally different methods of working, comment is unnecessary.

Let us glance at a summary of the results—

For trains of 80 tons weight:

Average *tractive* power supplied per train—	
Steam	73.6 h. p.
Sprague electrical system	43.1 h. p.
For 63 trains:	
Steam	4,640 h. p.
Sprague electrical system	2,715 h. p.
Total *steam* power supplied:	
Steam system	4,640 h. p.
Sprague system	4,525 h. p.
Any other electrical system	7,382 h. p.
Difference in last two	2,860 h. p.
Passenger capacity of each 80-ton train:	
Steam	151
Electrical	344
Passenger capacity of 63 80-ton trains:	
Steam	9,513
Electrical	21,672
Weight of train for 344 passengers:	
Steam	92.6 tons
Electrical	80.0 tons
Steam excess	12.6 tons
Weight of 63 trains for 344 passengers each:	
Steam	5,834 tons
Electrical	5,040 tons
Steam excess	794 tons
Passengers carried by—	
63 92.6-ton steam trains	21,672
Equivalent weight electrical trains	25,074
Excess with heavily loaded trains	3,402
Strains in any unit:	
Steam	100
Electrical	33 to 66
Cost of coal:	
Steam	$3.50
Sprague electrical	1.00

I have not thought it necessary to explain the particular methods of motor construction or regulation, or the system of generation and distribution. Let it suffice here to say that these matters have been thoroughly worked out to my satisfaction, and I anticipate no serious obstacles.

I have presented these facts about the present and future of the elevated roads of New York for your serious consideration, not because you are particularly interested in New York, but because the problem of rapid transit in Boston has become one of the urgent needs of the present. As the elevated roads in the former city met with great opposition, so has the project of reaching the suburbs of Boston aroused a host of objectors.

The reasons for this strenuous opposition are in part sound. Your streets are many of them narrow, some of them crooked. Property owners along the proposed route of a road object to a double track system of roads extending the full width of a street; to the noise, the steam, the water, the oil, the vibrations, the dirt and cinders incident to a steam system. But the elevated roads of New York were projected some years ago. Active minds of engineers and inventors have worked out improved methods of construction for the special needs of cities like Boston, where trains may be required to go by one street and return by another. Such roads can be built, the structures of which will not take up as much room in the streets, will not obstruct the air and light much over one-half as much as the New York roads, and I feel confident that they can be built for less money.

With electric propulsion you can have rapid and smooth-running trains of one, two, or more car units. The strain on the structure being much less than in a steam plant, the whole structure can be made lighter in the same proportion.

Dust, smoke, cinders, oil, and water will dissappear.

Power will cost less.

Trains can be run at shorter intervals and under more perfect control.

* A Paper read before the Society of Arts, Boston, Mass. Dec. 10, 1885.

The energy of the train will become available for the purpose of braking.

Repairs of the superstructure will be less.

In short, electric propulsion, more than any other thing, will make practicable for Boston what it has so long and so sadly needed—rapid transit to its suburbs. I need hardly point out to you the increase in the value of this property, which will more than pay the cost of the roads.

An Early Electric Railway.

Professor Page, it is interesting now to recall, made a trial trip with his electro-magnetic locomotive on Tuesday April 29, 1851, starting from Washington. The progress of the locomotive was at first so slow that a boy was enabled to keep pace with it for several hundred feet. But the speed was soon increased, and Bladensburg, a distance of, it is said, about five miles and a quarter, was reached in thirty-nine minutes. When within two miles of that place, the power of the battery being fully up, the locomotive began to run, on nearly a level plane, at the rate of nineteen miles an hour, or seven miles faster than the greatest speed theretofore attained. This velocity was continued for a mile, when one of the cells cracked entirely open, which caused the acids to intermix, and, as a consequence, the propelling power was partially weakened. Two of the other cells subsequently met with a similar disaster. The professor proceeded cautiously, fearing obstructions on the way, such as the coming of cars in the opposite direction, and cattle on the road. Seven halts were made, occupying in all forty minutes. But, notwithstanding these hindrances and delays, the trip to and from Bladensburg was accomplished in one minute less than two hours. The cells were made of light earthenware, for the purpose of experiment merely, without reference to durability. This part of the apparatus could therefore easily be guarded against mishap. The great point established was that a locomotive, on the principle of Prof. Page, could be made to travel nineteen miles an hour. But it was found on subsequent trials that the least jolt, such as that caused by the end of a rail a little above the level, threw the batteries out of working order, and the result was a halt. This defect could not be overcome, and Prof. Page reluctantly abandoned his discovery.

A New Printer.

There is now being exhibited in this city a new printing telegraph which embodies a number of novel and interesting features. The printer is the invention of Mr. Samuel V. Essick, of Alliance, O., and operates upon the step-by-step method in connection with a commutator, by which the instrument adjusts itself to the inequalities of the line currents, without manual adjustment, so that the printer can be applied on long lines without the necessity of frequent unisoning of the transmitter and receiver.

THE ESSICK PRINTER.

The key-board of the printer is so constructed that any one can transmit messages without instruction. The transmission is accomplished by closing the circuit at one point when a key is depressed and breaking it at another; the latter operation is accomplished automatically and does not take place until the finger is removed and the key returns to its original position.

The commutator mentioned above is the central element of the instrument. By means of this feature the difficulties experienced in operating telegraph printers on long lines are overcome, so that the length of line to a reasonable distance (1,000 miles, according to the inventor) will make very little difference in the operation of the invention.

If the currents are weak, this automatic commutator holds on to the point with which it is connected until there is sufficient accumulation of power to alternate the commutator points and cause a pallet to be moved to the opposite magnet.

Our illustration shows in perspective the printer, which, besides its electrical features, contains another ingenious adaptation, which gives it additional value. It consists of the paper carriage, which is also automatic, running freely back and forth, raising the paper without the aid of the operator, and printing the messages in page form as fast as they are supplied, thus avoiding the use of several yards of tape to convey a message that can be condensed into a few inches. Errors in transmission are avoided, in consequence of the transmitter making a duplicate of the message under the eye of the operator, so that a mistake will be seen and remedied as soon as it occurs.

The National Printing Telegraph Company, which has recently been incorporated in this city, controls Mr. Essick's inventions, and purposes establishing an exchange system in New York and the chief cities in the United States and Canada, for the purpose of furnishing telegraphic connection to merchants, bankers, lawyers and others direct from their offices. It is claimed that this can be operated at a smaller rental than is now charged by telephone companies. It is proposed to work through cables wherever practicable.

Messages have already been sent over 260 miles at the rate of 25 words per minute between this city and Philadelphia through aërial and submarine lines, and the inventor claims that a speed of 40 to 50 words per minute can be attained with an improved set of his instruments now being constructed. Such a system of exchanges will enable business houses having agencies in other cities, and individuals generally, to communicate directly with each other, and to record the communication, as any one can receive and transmit with this apparatus, which requires no telegraph operator.

A Phenomenon Observed in Arc Lamps with Hollow Positive Carbon.

BY ED. WAGEMAN.

I wish to call the attention of electricians to a phenomenon, which all will have observed in the behavior of the arc in the arc lamp, and may have puzzled over. The fact is, that when we have a very long arc, a flame frequently appears in the shape of a funnel, rising from the negative to the positive carbon, and it seems as if a wave motion, similar to that observed by standing near a hot stove, radiating the heat into space, were rising toward the positive carbon. This fact or phenomenon having been observed in the earlier experiments with hollow positive carbon, prompted me to try by extending the arc as long as possible, if no explanation could be found upon which to form a theory.

In my lamp the bore of the positive carbon was $\frac{7}{16}$ inch and the diameter of the negative carbon $\frac{1}{8}$ inch. As soon as the current is let on and the negative carbon is placed exactly in the centre of its surrounding positive carbon, the arc is established with the simultaneous appearance of a yellowish flame, which seems to issue from the negative carbon, but soon disappears. If now the observer examines the arc through a smoked glass, he will find the negative carbon dark, but the phenomenon above alluded to, namely, the wave motion, distinctly radiating from the negative carbon towards the inner surface of the positive carbon, raising a round spot *one-fifth* the inner circumference of the positive carbon to incandescence, and the arc moving from the right to left if the lamp is placed horizontally, and in the corresponding direction if the lamp is placed vertically. (Supposing the observer to look toward the arc and into the positive carbon.)

I have sought in vain for an explanation of this very strange phenomenon in text-books treating on electricity. My idea of the phenomenon is as follows, and I should like very much to know the opinion of other electricians and of physicists regarding it.

Suppose the phenomenon to be explained by assuming that electricity is the action produced by gravitation, or moving matter through space falling towards a centre of gravitation. Take, as an example, the planets falling towards the sun; the wave motion produced by this action by coming into contact with the body of the sun, raises the latter to incandescence. The wave motion acquires a gyratory character and increases in velocity as it approaches the sun's body. All matter within this zone will be carried instantly towards the large centre of gravitation, and will increase the effect. The reaction on the angle of reflection will send out a wave motion in opposite direction into space, radiating light and heat and chemical action. Now, in my opinion, it is proper to assign to the wave motion which approaches the centre of gravitation the negative sign; and the positive sign to the wave motion reflected by the centre of gravitation. It is evident that the body emitting a larger wave motion towards the centre of gravitation will have a larger specific heat, and the more remote it is from the source of gravitation the lower will be the density of the body; but the wave itself will strike with a greater force the centre of gravitation, but with less volume.

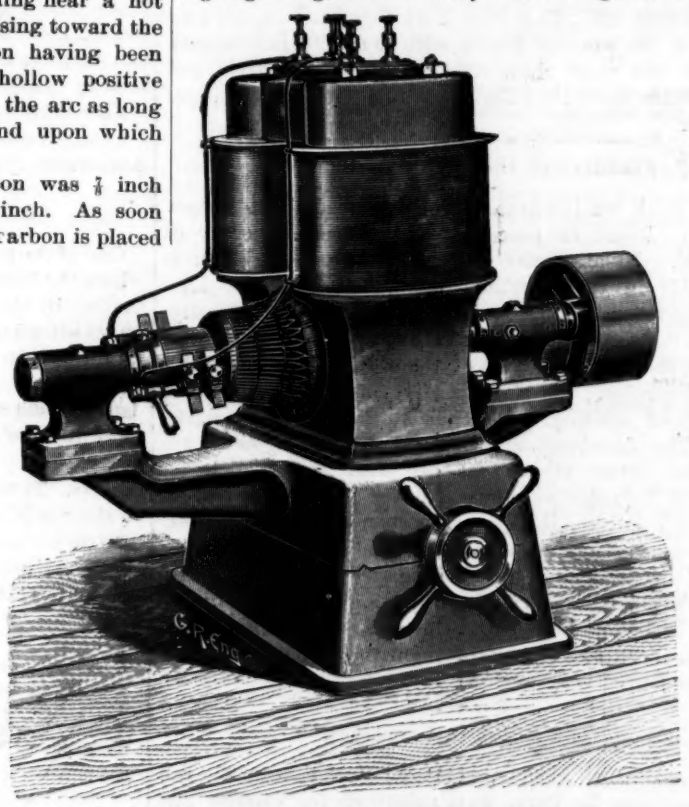
Now to return to the state of things on our earth. We ought to have a wave motion coming towards the earth from the moon. This motion, transformed into electricity, must have the negative sign, and inasmuch as our earth is turning on its axis from west to east, the current of electricity generated by the weak wave motion resulting from the falling of the moon towards the earth ought to be in the direction from east to west, or facing the north pole, from right to left. And the reaction current caused by the wave motion, which ought to move from west to east, ought to have the positive sign. It would lead me too far to extend the theory further. But enough has been said in regard to the theory here proposed to form the conclusion that the flow of the current is from the lower towards the higher potential; that the flow of current as characterized by our nomenclature is really the flow of wave motion in a state of reflection or reaction.

One more instance may be cited. It is the electric action going on in electrolysis and in the galvanic batteries, which indicates the flow of the current very clearly.

I hope soon to see the opinion of others on this point.

The Thomas Dynamo.

Among the recent designs of dynamos is the machine of Mr. Wm. M. Thomas, which is shown in the accompanying engraving, and has lately been brought out. It presents several novelties in mechanical construction. As will be seen, the base or bed-plate is of the well-known "box" pattern, insuring rigidity, and furnishing the means whereby the belt can be readily tightened by a single screw; the machine thus always remains in line.



THE THOMAS DYNAMO.

The base is very heavy, and the arms carrying the boxes for the armature shaft are so braced as to avoid any vibration of either shaft or armature. The boxes are bushed with gun metal, and are self-oiling, the base of the box being cored out, forming an oil chamber; the oil is fed to the shaft by means of a flat wick revolving with the shaft. The ends of the boxes are provided with stuffing-boxes to prevent wastage, and also to prevent oil from "throwing" on the machine, that being so destructive to insulation. The commutator is thoroughly insulated, and is so constructed that there is no possibilty of any copper dust collecting thereon. One danger of short-circuits is thus obviated. All parts of the machine are interchangeable, and simplicity of construction and consequently freedom from damage arising from multiplicity of parts are thus obtained. In the incandescent dynamo the construction is such that the machine is entirely self-contained or automatic, no resistance coils, governors, or any outside device being necessary. The machine can be run to its full capacity, and switched down to one lamp without any fluctuation in the lamp left burning. Owing to the fact that no resistance coils are used, the power required for operating the dynamo is proportionate to the number of lamps that are in operation. The arc and incandescent machines are identical in construction, with the exception of the winding of armatures and field magnets. The "Thomas" arc lamp and regulator for the arc machines, together with the machines, are built by the Farmer Roller Mill Company, of Grand Rapids, Mich.

Telephone Statistics of Europe.

The statistics of our telephone growth make some of the most interesting reading, and especially so when we compare them with those of foreign countries. While America is the home of the telephone. and it is natural to suppose that we might be somewhat in advance of other countries, our readers will hardly be prepared to see in what a remarkable manner we have distanced every other country individually and even the whole continent of Europe collectively. In a recent pamphlet entitled "Situation des Réseaux Téléphoniques," published by the *Bulletin International de L'Electricité*, we find the statistics of the advance in every European country in which the telephone has been introduced. They are given below:

	1st January, 1883.		10th December, 1885.	
	Exchanges.	Subscribers.	Exchanges.	Subscribers.
Germany	21	3,613	91	14,733
Austria	3	870	11	3,032
Belgium	6	1,941	7	3,365
Denmark	1	516	2	1,370
Spain	3	....	3	594
France	18	4,437	20	7,175
United Kingdom	75	7,287	89	15,114
Italy	13	5,507	16	8,346
Netherlands	4	1,340	8	2,493
Portugal	2	80	2	350
Russia	6	1,351	20	5,280
Sweden	5	1,554	15	5,705
Switzerland	2	825	36	4,900
Total	159	29,321	320	72,457

Comparing these figures with our own, some curious facts are brought out. There are now in operation in the United States 782 telephone exchanges and nearly 350,000 instruments. Assuming our present population to be 60 millions, and that of Europe to be 300 millions, we have 25 telephones to their 1.

England shows the largest number of subscribers and exchanges in Europe. It is closely followed by Germany in the number of subscribers, but from that point there is rapid falling off. Thus New York City has as many telephones as the whole of Russia with 70 million inhabitants. Chicago has more than either Belgium or Austria, and Philadelphia more than Denmark, Spain and Portugal put together.

Features of the New Law Battery.

Last week we illustrated and described the new Law battery. There are one or two points still worthy of mention. In all plates of carbon a great variation is noticeable in their contact resistance. The new Law prisms have been so prepared as to overcome this difficulty, and the resistance of the cells is as low at the moment of starting the battery as that of the ordinary carbons after long immersion. The electromotive force is also full at the moment of starting, which has not heretofore been the case. The depolarizing properties of these elements are such that when these cells are used as open circuit batteries, the negative element never has to be replaced. In the new covers, the central carbon is perfectly sealed, and is secured against accidental displacement by being seated in a wedged-shape opening and sealed by cement placed within a flange cast in the glass. When the two elements, carbon and zinc, are in place at the starting of the battery, there is no way for them to make contact, and they are perfectly insulated from each other.

The Light in Carriages.

The success of the incandescent electric lamp for private carriages in Paris, as a substitute for candles and oil lamps, is pronounced complete. Not only the regular side lights are included in this plan, but the interior of the vehicle is illuminated by a lamp sufficiently powerful to read by, and in some instances a similar lamp is placed, for a novelty, on the head of the horse. The lamps are connected by wires with small accumulators placed under the driver's seat; they are small in size, being only about eight inches square and four inches high, each of such accumulators being able to supply a lamp of five candle-power for the space of some six hours. During the day they are removed and charged with electricity from a dynamo machine or otherwise, and at night they are ready for use.

A Scrip Dividend of the Southern New England.

The Southern New England Telephone Company presented its shareholders lately with a scrip dividend through the following circular:

"In issuing to the stockholders this dividend of 2 per cent., the officers of the company desire to inform them that this, together with an arrangement made with the American Bell, disposes of all the remaining treasury stock of the company.

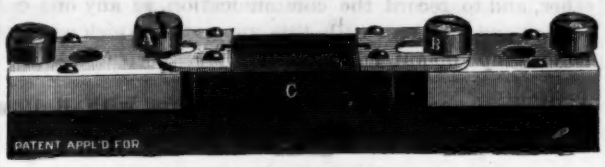
"Our capital stock now issued is $1,500,000, of which $975,000 represents the property and $525,000 the franchise of the company. By the terms of our permanent contract, entered into in August, 1884, the American Bell Telephone Company is entitled to participate in the net earnings of the company accruing after Jan. 1, 1886. As the net earnings of the company have not, as was anticipated at the time the contract was made, increased to such an amount that a dividend of 6 per cent. can be paid upon all the stock, representations of this fact and of the general status of the company have been made to the American Bell, and negotiations have been had with them, the result of which has been an agreement between the two companies by which the American Bell waives its rights to dividends upon its franchise stock after it has received 3 per cent. thereupon until 6 per cent. has been paid to the property stockholders. In view of the present earnings of the company and of the increase therein arising from the recent increase in rates, we feel that we can reasonably assure property stockholders that cash dividends will be paid upon their stock hereafter which will amount to 6 per cent. per annum.

"In making this announcement to the stockholders we have given the results rather than the details of the arrangement with the American Bell Telephone Company, but more detailed information will cheerfully be given upon inquiry at the office of the company."

The Chinnock Current Arrester.

We illustrate below a new device, designed by Mr. C. E. Chinnock, for protecting telephone and telegraph instruments from lightning, or from excessive current when a cross occurs with electric light or other wires.

The illustration shows the full size of this safety catch,



THE CHINNOCK CURRENT ARRESTER.

which, as will be seen, consists of two parts; the black rubber base with brass plates at each end having screws under which to place the wires, and the centre piece *C*, which holds a piece of fine lead wire. This centre piece is slotted, and, when the safety wire is burned off, can be taken out by giving the screws *A* and *B* a turn. A new piece *C* is then put in, and the circuit is restored. This can be done in less than half a minute, as will readily be seen by examining the cut.

This simple current arrester is manufactured and sold for the inventor by the Stout-Meadowcroft Company, 21 Ann street, this city.

A New Valve Electric Gas-Burner.

One of the most convenient adjuncts to gas illumination, where the latter is unavoidable, is the method of lighting the jets by electricity. It does away with the match and all its attendant evils, and is an ever-ready means which requires little or no attention. Various forms of electric gas burners have been devised, and are known as "pendant," "ratchet," "automatic," etc., depending upon their mode of operation. In the first the gas cock is turned on as usual by hand, and a pendant is pulled which ignites the gas. In the "ratchet" burner, the trouble of turning on the gas is obviated, and one movement suffices both to turn on the gas and to ignite it, which is accomplished by successive movements of a lever.

We illustrate in the accompanying engravings a device

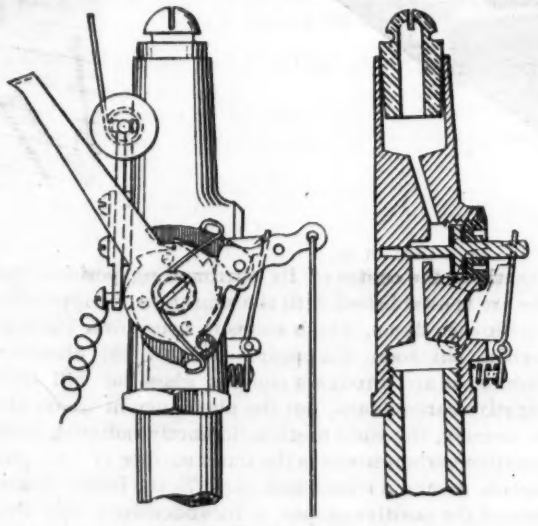


FIG. 1. FIG. 2.

A NEW ELECTRIC GAS LIGHTING DEVICE.

designed for this purpose by the Rousseau Electrical Works, of this city. Figs. 1 and 2 show respectively an elevation and a section of the burner, the operation of which is very simple. As will be seen, the valve employed is of the "puppet" type and unpacked. The outer end of the valve stem is pierced by a lever, the other end of which bears against a spring. In the position shown in Fig. 2 the valve is open, and is retained so by the cam resting against the upper arm of this lever, as shown in Fig. 1, and in outline in Fig. 2. By pulling down the pawl which manipulates the ratchet the cam is released, and the spring pressing against the valve lever throws the valve back to its seat, thus shutting off the gas. The ratchet mechanism is so arranged that one motion of pulling down the lever to which the pendant cord is attached throws the cam forward and opens the valve, at the same time bringing the igniting lever forward to form a spark, which lights the gas. By pulling down the pendant a second time, the gas is extinguished, as already described.

The construction of the valve mechanism is such that the gas-valve will not be locked open until after the igniting-spark is produced, so that if the manipulating device is pulled partly forward and then allowed to retire, the valve will only be partly opened and again closed, thus preventing the possibility of leaving the gas turned on without igniting it.

New Officers of the American Electric Manufacturing Company.

Few signs of the time are more significant and more hopeful than the manner in which men of prominence in the business community are interesting themselves in electric lighting. It has come to be recognized that wherever gas has been or is likely to be used, there is a field for electricity, and that, properly run, a lighting plant of either arc or incandescent, or of both, is a good, sound investment, capable of yielding a large and steady profit. Hence the industry was never in better shape, nor was there ever more activity displayed in it. An evidence of the remarkably favorable attitude of capital toward the illuminant—new and experimental no longer, but in demand everywhere as an established success—is seen in the recent election of directors of the American Electric Manufacturing Company. These gentlemen are Levi M. Bates, of Bates, Reed & Cooley; Lewis May, the banker; R. N. Hazard, President of the American Loan and Trust Company; ex-Senator John J. Kiernan, proprietor of the Kiernan Financial News Bureau in Wall street; and H. C. Adams, the New York agent of Holmes, Booth & Haydens. We think it will be admitted by all that this is a strong list, confirming very forcibly the statement made above.

We have already described the system under which the American Company proposes to carry on its business—depositing with a trust company the stock in local companies formed by it, and issuing against that stock 6 per cent. twenty-year debenture bonds. In each of the local companies the parent company holds a controlling interest, and thus derives a return as well from its stock as from the installation of the plant and the continuous supply of operating material. The well-known financial house of A. S. Hatch & Co. has now been intrusted with the marketing of the debenture bonds in this country, and it is thought that the security will command the attention of investors satisfied with the rate named.

In order to facilitate its growing business, the company will from April 1 next have its executive offices in the Mutual Life Building, 146 Broadway. It reports great activity of business, and is now engaged in the completion of several contracts and the formation of new local companies.

Closed Circuit Batteries.

To the Editor of The Electrical World:

SIR: Will you please to tell me through the columns of your paper whether a battery would last longer on a closed circuit than on a circuit alternately opened and closed, after the fashion of an electric bell in a circuit?

BOSTON, FEB. 12, 1886. E. J. O.

[ANS.: A closed circuit battery will last longer on open circuit than on closed.—EDS. E. W.]

Incandescent Lamp Circuit.

To the Editor of The Electrical World:

SIR: Why does not the first lamp in an incandescent circuit tend to lessen or short circuit the current?

YANKTON, Dak. W. T. B.

[ANS.: It, and the others, tend to short circuit the generator, and when sufficient lamps are arranged in multiple arc the generator is short circuited. It should be remembered that the resistance of an incandescent lamp is usually very high as compared with that of the dynamo.—EDS. E. W.]

Arc Lamp Shunt Coil.

To the Editor of The Electrical World:

SIR: Please answer the following through the columns of your paper: Of what resistance should the shunt coil of a 2,000 c. p. arc lamp be composed, or how can I find the right resistance in constructing a lamp?

PEKIN, ILL. H. G. S.

[ANS.: This depends entirely upon the power of the main coil and construction of the lamp. In general, however, it ought to be high; between 100 and 200 ohms and over.—EDS. E. W.]

The Dynamo and the Motor.

To the Editor of the Electrical World:

SIR: In a recent number of THE ELECTRICAL WORLD I find an article by W. M. Mordey on electro-motors.

He seems to be unable to find the difference between the dynamo and the motor, nor does he seem to be able to give the reason why the dynamo, when used as a motor does not work so economically.

Let me offer an explanation. In the dynamo great care is taken to suppress Foucault currents, of course only in the armature, since that is the only part in which currents are induced. In the motor we have different conditions altogether.

In the motor the armature is also charged, as well as the field-magnet, and, consequently, it acts like a field-magnet on the field-magnet proper, and induces Foucault currents

in its pole-pieces, if not in its whole mass of iron. But thus far motor-builders have not sought to suppress these induced currents by laminating their field-magnets; hence the loss of power. H. HELLMICH.

JACKSONVILLE, Fla., Feb. 16, 1886.

[Our correspondent seems to have misconstrued the contents of Mr. Mordey's paper. Mr. Mordey points out the same thing as our correspondent, viz.: that the effects of the Foucault currents ought specially to be guarded against in the electro-motor. Our correspondent's suggestion regarding the lamination of the field-magnets seems to be a good one, though it has already been applied in the construction of dynamos.—EDS. E. W.]

The Self-Induction of an Electric Current in Relation to the Nature and Form of Its Conductor.

BY PROF. D. E. HUGHES, F. R. S.

(*Continued.*)

INFLUENCE OF PARALLEL CURRENTS.

The instrument being well adapted for showing the slightest change in the self-induction by the reaction of one portion of the current upon the other when in the same direction, as in a coil, or in the opposite direction, as in a parallel return wire, I made a series of experiments in order to observe the influence of different metallic conductors in this respect.

Two silk-covered iron and copper wires of similar diamter and length (1 mm. diam., 2 mètres in length) were each formed in a single loop of 66 cm. diameter. The extra-currents from iron were, as usual, six times stronger than those from a similar loop of copper. On closing the loop by bringing the opposite sides in close proximity, and thus making a parallel return wire (the current ascending on one side and descending the other), I found that the reaction of currents in opposite direction was very different with different metals, the results depending more upon the nature of the metal than upon the proximity of the wires.

There was a reduction of the previous force of the extra-currents in iron, when forming a parallel return wire, of 15 per cent., while the reduction in copper was 80 per cent. Thus the currents in copper are far more influenced by an external wire than those in iron; consequently, a telephone line having its return wire in close proximity should invariably be of copper, as not only is its specific inductive capacity less, but this is again reduced by the return wire, so that its self-induction is far below that of iron.

In order to observe the influence of currents in the same direction, the same wires were formed into a close coil of twelve turns of 2 cm. diameter; and from the known effects of parallel currents in the same direction, we should expect a greatly increased effect. It was so in the case of copper, but iron was far less under the influence of an external parallel current; the strength of current in iron when formed into a coil being 57 per cent. greater than that of a single wide loop, while in copper the increase was 404 per cent., or seven times the increase of iron; and although iron when in a single wide loop had six times the force of copper, the comparative strength was reversed when the wires were wound as a coil, the extra-currents from the copper coil then having 14 per cent. greater strength than that from iron, and this difference could be rendered more evident by employing longer wires.

Thus copper, as regards extra-currents, is far more sensitive to the influence of external currents than iron, and the true self-induction from its own current can only be obtained by a straight wire, where the return wire is at such a distance that its influence is not appreciable.

REACTION OF CONTIGUOUS PORTIONS OF THE SAME CURRENT.

It is well known that currents in separate portions of the same wire (as in a coil) react upon each other, and I felt convinced from the preceding experiment that self-induction is entirely due to similar electro-magnetic reactions between contiguous portions of the current in its own wire. Let us assume that an electric current consists of a bundle or an almost infinite number of parallel currents, the limit being a single line of consecutive molecules; then each line of current should, by its electro-magnetic action, react on each of the others similarly to wires conveying separate portions of the current, and the self-induction should be at its maximum when the lines are in the closest possible proximity, as in a conductor of circular section, and far less when separated, as in one of ribbon form, where the outlying portions are separated by a comparatively great distance: there would still remain, in the latter case, the reactions from the near portions on each other, and these should again be reduced by cutting the ribbon into a number of thin narrow strips separated, except at their junction, to a sufficient distance to prevent any marked reaction.

My experiments prove that this assumption is an experimental fact; for we can reduce the self-induction of a current upon itself to a mere fraction of its previous force by simply separating (as indicated) the contiguous portions of a current from each other, the results proving that a comparatively small separation, such as is obtained by employing ribbon conductors in place of a wire of the same weight, reduces the self-induction 80 per cent. in iron and 35 per cent. in copper; and if we still divide the current by cutting the ribbon into several, say 16, strips (separating the strips at least 1 cm. from each other), then the combined but separated strips show a still greater reduction, being 94 per cent. in iron and 75 per cent. in copper.

The following table shows the comparative reduction of self-induction by employing ribbons and parallel separated wires:

TABLE II.

Flat strips compared with Round wire 30 cm. in legth.	Copper	Iron.	Parallel wires 30 cm. in length.	Copper	Iron.
Wire 1 mm. diameter	29	100	Wire 1 mm. diameter	20	100
STRIPS.			SINGLE WIRE.		
0.25 mm. thick, 2 mm. wide.....	15	35	0.25 mm. diameter	16	48
Same, 5 mm. wide..	13	20	Two similar wires...	12	30
" 10 " " ..	11	15	Four " " ...	9	18
" 20 " " ..	10	14	Eight " " ...	8	10
" 40 " " ..	9	13	Sixteen " " ...	7	6
Same strip rolled up in the form of wire	17	15	Same, 16 wires bound close together.	18	12

The resistance of a conductor, or even the nature of its metal, has less influence on its self-induction than the form given to that conductor, the 1 mm. wire in the above table having a less resistance than the strip of 2 mm. wide, and a greater than any of the wider strips; but through all these variations we notice a gradual fall from the wire to the widest strip or ribbon, with a marked return to its previous force when the ribbon is rolled up in the form of a wire.

The reduction is greater in iron than copper, but its increase when rolled up is less than copper, thus agreeing with the previous observations on the difference of iron and copper to external reactions.

A still greater reduction takes place when we separate a current by using parallel wires separated 2 cm. from each other, as shown in the table. We then have a similar reduction to that produced by cutting the strips into several separate conductors; and we again remark that when the wires are brought close together (forming a stranded wire) copper rises in a far greater proportion than iron, the 16 fine iron wires twisted together as a stranded wire having 88 per cent. less induction than a solid wire of similar weight, a remarkable fact being that while a solid iron wire has an inductive capacity 80 per cent. greater than a solid copper wire, this is completely reversed when each metal forms a stranded wire of the same weight as the solid, for iron then has 33 per cent. less self-induction than copper.

It is not necessary to use extremely fine wires when we desire to reduce the inductive capacity of iron to that of copper, for I have formed stranded wire rope of 16 strands of wire where each wire was 1 mm. in diameter, giving 75 per cent. less induction than a solid wire of the same resistance. I purchased an ordinary wire rope of 6 mm. diameter, having 6 strands of 6 wires, each 0.5 diameter; this gave the best result yet obtained, for, on comparing 3 mètres of it with a similar length of solid iron wire of the same resistance, the 36 stranded wire had only 5 per cent. of the amount of induction shown by the solid wire.

Steel, in the form of ribbon or stranded wires, shows a similar effect to that of iron; and it is a remarkable fact that while the extra-currents from a steel or iron wire 4 mm. in diameter are extremely slow, and impossible to balance without reducing the time of the sonometer current (by the introduction of an iron core), the ribbon or stranded wire requires no such compensation, for its feeble extra-current is exceedingly sharp, and can be balanced to a perfect zero, being actually quicker than that of a solid wire of copper of the same resistance. This fact I regard as one of great importance for telegraph lines and lightning conductors.

A curious effect takes place if we employ mixed conductors, such as a compound wire of copper and iron. A fine coating of copper reduces the induction in a solid iron wire in a marked degree. This I found to be due to the difference of electromotive force of the extra-currents in the two metals, for, by employing a fine copper wire parallel with an iron wire, and in contact at the ends, the extra-current was reduced 60 per cent. The copper wire, having a lower electro-motive force, probably acts as a shunt; but if the capacity of the iron has already been reduced, as in a sheet or stranded wires, then the addition of a single copper strand increases the force, as the electromotive force of the extra-currents of copper is above that of stranded iron.

There has been for many years a discussion as to the merits of the round form as compared with the tape or ribbon form for lightning conductors. Those in favor of the former based their conclusions on experiments which gave a negative or no apparent difference between the two forms of conductors. Those in favor of ribbon conductors, as Sir W. Snow Harris, Prof. Guillemin any many others, based their opinion upon marked differences found when using high charges of static electricity. The latter supposed that there was a difference between discharges of static electricity and voltaic currents of low tension, and that the advantage recognized by almost conclusive experiments was due in a great measure to conduction by surface.

[TO BE CONTINUED.]

Titwillow.

A merchant once at the telephone
Cried hello? hello? hello?
To his ear came no answering tone
Of hello? hello? hello?
Then he slapped his chest with all his might,
And cried, "By gosh this thing ain't right;
That girl at the Central's gone to-night
To the skating rink with her fellow."

—*Boston Courier.*

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, March 8, 1886.

There is unusual interest at the present time in solutions for primary batteries, and various new claimants in this line for public favor have been put forward lately. One leading solution, for light and power purposes, is the Ampère-Volt. Mr. T. L. Gerry has great faith in the lasting qualities of this solution, to which he has paid considerable attention, and he will be glad to give details to any interested in the use of solutions and desirous of purchasing. His address is 48 Broad street.

The Roberts-Brevoort Electrical Company, Limited, has been formed with a paid-up capital of $100,000. Its president is E. Tweedy, a large manufacturer; treasurer, Henry L. Brevoort, mechanical engineer and president of the Roberts Battery Company; secretary, B. T. Vetterlein, and electrician, J. L. Roberts. The offices are at 206 Broadway. The object of the company is to introduce electric light and power for household use with the assistance of the Roberts battery. The company are already preparing several plants of from 12 to 15 lights of 12 c. p. each, in private residences out of town; and these they propose to use as a practical demonstration of the operativeness of their system.

The Brooklyn Electric Light Company has been organized with Messrs. Nichols, Goodrich and Kalbfleisch as incorporators, for the purpose of introducing in the City of Churches the Knowles-Moffat system of the Brooklyn Electric Construction Company. The new company will be prepared to do a lighting business anywhere in and around the city, and especially in the vicinity of the factory, York and Washington streets.

Mr. John V. Stout, formerly General Manager for the Bell telephone in Eastern Pennsylvania, and who has done considerable telephone line construction, is now giving the whole of his time to the duties of Agent for the Consolidated Telephone Company (Shaver acoustic system) for Eastern Pennsylvania. The company are now represented by him at Easton; Klotz & Lattig, Mauch Chunk; J. D. Condict, Denver; G. Henzel, San Francisco; A. S. Aloe & Co., St. Louis; H. V. Condict, Jersey City; S. C. Fay, Los Angeles, Cal. The Northwestern Electric Company, St. Paul, Minn., has applied for an agency, and ordered goods. D. Killion, the agent at Philadelphia, fitted up 28 instruments between Jan. 9 and Feb. 3. One very good feature in the Shaver instrument, as evidenced during the late gales, is its ability to suppress all noise from wind while giving conversation with the utmost clearness.

Hawthorne & Frisbie, 40 Cortlandt street, selling agents for the Shipman engine, report brisk sales of the new 2 h. p. engine. They expect to have the 3 h. p. engine ready by April 1. I hear on good authority that a well-known electrician living near New York is using a 2 h. p. Shipman and gets 3½ h. p. out of it for house lighting with incandescent lamps.

I notice that Mr. S. H. Willard, vice-president and treasurer of Holmes, Booth & Haydens, has become a director of the Preferred Mutual Accident Association. Another director known to electricians is Kimball C. Atwood.

Under the decision of Judge Wallace in his favor, against C. H. Hinds, Mr. A. L. Bogart is now instituting proceedings, he tells me, in every part of the country, against infringers of his patents on multiple gas lighting burners. He says several firms have "walked up to the captain's desk" and settled in full his claims. It is reported that by the time he gets through, Mr. Bogart will have recovered the snug sum of $74,000 in this way.

The Galvano-Faradic Company have just out a new acid battery for electric lighting, of which 8 cells give light equal to that of a 6 c. p. lamp. They can be used for 1, 2, 3, 4, 5 or 6 c. p. lamps, for all practical purposes. The cost is only $15, lamps and cautery extra. The battery is compact and can be easily carried about. It is sealed completely when the cover is down, and hence there is no spilling. An interesting exhibition was given of the battery and light on March 4, before the New York Academy of Medicine, by Dr. H. G. Piffard.

An ingenious arrangement to guard against the spread of fire has been placed by Messrs. Tucker & Baxter, at Pier A, North River. It consists of an iron door weighing 750 pounds, which travels on an incline. It is held open by a latch which can be released, electrically, from any part of the building. It operates automatically by being in circuit with the thermostats, with which the whole pier has been fitted up. The room to which this door admits contains valuable records of the Dock Department.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, March 8, 1886.

At the State House on Friday, 5th, the committee on mercantile affairs heard the closing arguments on the question of State regulation of telephone charges. Hon. George A. Bruce, for the American Bell Telephone Company, urged that a reduction of rates to $3 per month would wipe out every telephone in the State, and that the passage of the proposed legislation would work the greatest injustice to the companies. Mr. Samuel J. Elder presented similar arguments in behalf of the New England Telegraph and Telephone Company.

Senator Lilley, of the committee, submitted a bill, providing that any corporation leasing telephone instruments to sub-companies in Massachusetts shall not charge more than $1 per year as royalty on each set of instruments.

The Household Electric Light Company, with factory and office at No. 153 Essex street, this city, is meeting with marked success with its system for lighting dwell-

ings, offices, small manufacturing concerns, etc., etc. This company manufactures 5, 10, 15 and 20-light dynamos for incandescent lighting, and these small machines combine all the good points to be found in large dynamos and are free from many faults frequently found in small machines. Close inspection of the small dynamos referred to demonstrates the fact that there is no sparking at the brushes. The company has facilities also for furnishing small arc light plants.

The factory of the Redding Electrical Company had a narrow escape from damage by fire on Saturday afternoon, the 6th inst. It adjoins the American House, which came so near being destroyed by fire on the day mentioned, and it would have suffered but for the promptness and ability of Boston's fire department.

The Ball Electric Light Company has received the contract for the installation of its system of both arc and incandescent lighting on the premises of the Dunnell Manufacturing Company, Providence, R. I. The plant will consist of 40 arc-lights, and 50 incandescent lights of 16 candle-power each, the latter being run off the arc circuit.

Major Thos. H. Winsor, for some time past identified with the Baltimore & Ohio Telegraph Company's central office in this city, was recently appointed electrician for the Atlantic Telegraph Company at Portland, Me.

The New England agency of the Consolidated Electric Light Company reports having recently installed an incandescent plant of 150 lamps at Northampton, Mass., in the silk manufactory of Messrs. Belding Bros. The company has also just finished the installation of a 30-arc light plant in the same town, using the Thomson-Houston system.

The Providence Steam Engine Company, Providence, R. I., have been very busy of late filling orders for the improved Greene Automatic engines, one of which was 700 horse-power.

The Chemical Electric Light and Power Company have moved into their new quarters, 109 Court street, and are now ready to fill all orders for Volta Pavia solutions on short notice. Their tank capacity is 800 gallons per day, and it can be increased with the demand to 1,000 or 1,500 gallons. The company will keep in stock in addition to their Volta Pavia, single and double cells, batteries of all kinds, incandescent lamps suitable for battery currents, electroliers and lamp fixtures, electric motors and battery supplies generally, and propose to introduce their Volta Pavia system into practical and general use. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, March 8, 1886.

The Electrical Maintenance and Construction Company, composed of the following well-known gentlemen, Thomas S. Harrison, A. F. Moore, W. F. Russell, James A. Wright and David Brooks, the inventor of the underground cable system used by this company, met the Electrical Committee of the Councils on Wednesday last, and escorted them to the Broad street station of the Pennsylvania Railroad, where a thorough test was made of this system. Comparing the workings of underground and overhead telephone wires, of the same length, it was found that the underground wires worked much better and with less induction. In fact there was so much induction on the aërial wires connecting Kensington, six miles away, that it was impossible to converse at all.

Chairman Graham of the committee declared himself as well pleased with the working of the underground wires. The company have had wires working for some time in this city and have experienced but little trouble. The metallic circuit used by Mr. Brooks on the lines from the Pennsylvania Railroad Company's offices on Fourth street in this city renders it a pleasure to use the telephone rather than an annoyance, as it is when the induction is so great.

The proposition was made to the committee that the company at their own expense lay down their system along all streets between the Delaware and Schuylkill rivers and Vine and South streets, the city to have full control and to charge the annual rental of $30 a mile for each wire used by corporations, firms or individuals. The city to have free for its own use all wires necessary for its business.

In addition to the free use for public purposes, the city is to receive 25 per cent. for collecting and handling the rentals.

David R. Walker, Chief of the Electrical Department, in submitting to Mayor Smith his annual report for 1885, refers to the visits of the Electrical Committee and himself to other cities to see what advance had been made in disposing of overhead wires and the probable cost of placing the wires under ground, either in conduits or insulated cables. He found that there were different systems in use and no uniformity of construction.

The returns made to the department for poles, wires, conduits, attachments to city poles and mileage of wire amounted to $25,472.50, of which sum $8,987.50 has been paid into the City Treasury, leaving unpaid $16,485, a portion of which is in the hands of the City Solicitor for collection. There were, according to the returns on December 31, 1885, on the city highways 4822 poles, exclusive of those along railroad tracks and city poles, being an increase of 191 over 1884; 4,368 miles of telegraph and telephone wires, a decrease of 131 miles; 157 miles of electric light wires, an increase of 42 miles, making a total of city and all other overhead wires of 5,063 miles, being an increase of 38 miles over the previous years; 8,508 poles, being an increase of 418; 11,039 attachments to city poles, a decrease of 1,233; to support 363 miles of wire, a decrease of 131 miles. There were issued 386 permits for erection of wires and general repairs of lines, a decrease of 351, this decrease being mainly caused by the position taken by Councils against the overhead service, and a determination to stop their accumulation and place them under ground, and the refusal of the department to issue permits, except where necessity required.

There were 198 electric lights maintained during the year at an average cost of 53¼ cents per lamp per night. As a result of this, 425 gas lamps were ordered to be extinguished. He recommends the placing of fire signal instruments in every building such as hospitals, asylums and houses where helpless persons are confined, to enable them to summon assistance, and in every school, theatre, etc.

Chief Walker asks Councils to make an appropriation for the establishment of a repair and construction shop, with the necessary machinery, tools, etc.

The above report makes a good showing for the city, especially as to the doing away with 425 gas lamps and the placing of electric lights. Mr. Walker's idea in regard to the establishing of a city workshop is likely to have the hearty approval of Council.

Mrs. Christie, wife of Mr. Joseph Christie, of the Associated Press, of this city, a gentleman well-known in electrical circles and personally acquainted with many readers of your paper, died at her home in this city on Tuesday evening, March 2, from the effects of burns received about three weeks ago, while endeavoring to tear down a parlor curtain, which one of the children had accidentally set on fire. Very keen sympathy is felt with Mr. Christie in his severe misfortune.

An alternative mandamus was granted by Judge Arnold on Wednesday last against Chief Walker, of the City Electrical Department. The complainants in the case are the Philadelphia Electric Light Company, and in their petition they say that, desiring to carry out their contract with the city for furnishing electric lights on Columbia avenue, west of Sixth street, and on Montgomery avenue and Thirteenth street, they asked for a permit to erect poles and wire for that purpose, but Mr. Walker refused to grant it to them. Mr. Walker refused to grant their permit because another company had erected poles on the same streets, and he thought the complainants could use these poles. To this the company answer that the other company will neither rent nor sell the poles. The writ is returnable on the 13th.

The effects given by the electric lights in the different scenes at the Temple Theatre in this city are wonderful. The success and long run of the present opera, *The Little Tycoon*, can in a measure be attributed to this feature.

E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, March 6, 1886.

Considerable activity is being manifested by the so-called "opposition" telephone companies, and new ones are being organized. They see a chance, they think, to do some business after a while, and intend to be as near ready as possible when a favorable opportunity for starting up arrives. The Inter-State Company have settled their troubles among themselves, and once more present a united front. And above all, the opposition companies have an exceedingly industrious and vigorous newspaper organ here, which is helping in no small degree to pave the way for future business by furnishing from day to day large quantities of very interesting telephone reading matter. Of course these newspaper articles may be, as some evil disposed people say, merely advertisements to help the sale of the company's stock, but they are interesting just the same, and if we may believe the holders of the opposition stock, share selling is a matter of minor importance with them, the principal thing being to get an exchange in operation. It is claimed that the city has already been canvassed for subscribers for a new company at rates about half the existing ones. One thing is sure, there is a good deal of bustle and activity among opposition telephone companies here just now.

An explosion occurred in the underground conduit, corner Clark and Madison streets, lately, which was of sufficient force to blow the heavy iron manhole cover high up in the air. Although this is a crowded and busy corner, no one was hurt. The explosion, however, was heard at quite a distance.

After the hottest kind of a fight, extending over two years, the controversy over removing telegraph poles from the streets of Detroit has been settled, and the city attorney has framed a notice for the Board of Public Works to send to the various electric light, telegraph and telephone companies. The companies are ordered to remove their poles at once, and are expected to comply without further opposition. The Board of Public Works are required to remove the poles if the companies fail to do so.

Mr. Chas. Reitz, electrician, Indianapolis, has just perfected and put on the market a splendid small magneto electric light machine for physicians. It is put up in a neat case, each machine furnished with a ½ candle and a 1 candle-power lamp connected to a flexible handle, the whole weighing between 6 and 7 pounds and making one of the neatest and handiest machines for the purpose intended.

The *Illustrated Graphic News*, Chicago's new pictorial weekly, gives Electrician Sperry and his Board of Trade lights a full page of illustrations in its first issue, just out.

A. L. Ide & Son, of Springfield, Ill., are sending the Springfield, Mo., Electric Light Company a 125 horse-power engine, this being the second Ide engine furnished that company. The Edison Electric Light Company, Laramie, Wy., have just ordered two 100 horse-power Ide engines with complete outfit.

The Universal Electric Company, Chicago, has been licensed.

The Oskaloosa Gas Light Company, Oskaloosa, Ia., who have for some time past been renting power for driving their electric light station, have determined to put in their own steam plant. They have accordingly placed their order with the Pond Engineering Company, of St. Louis, for their entire outfit of steam and motive power. Their contract includes a 50 horse-power Armington & Sims engine, two 50 horse-power steel boilers, two sets Sheffield grates, two Jarvis boiler settings, Korting injectors, etc. It is expected that the plant will be in operation early in April.

There are many indications going to show that the gas companies are at last coming to a common sense view as regards the electric light. The following extract from a letter from a prominent gas man indicates that the writer believes that gas companies who are dealers in light should be in a position to furnish the light called for, whether it be gas or electric:

"I consider the electric light in the long run a decided benefit to the gas company of any city, more especially where the plant is owned by the gas company, and located on their own premises, as I am convinced that great economy of fuel and labor expenses is thereby gained. It has always been my opinion that gas companies should keep an assortment of goods such as gas, electricity and fuel gas, just as much as any other merchant keeps an assortment of his particular line of goods. The electric light has its field and will surely hold it."

The Metropolitan Electric Light Company has been organized.

W. A. K.

THE TELEGRAPH.

The "Air Telegraph."—Mr. Edison contributes to the *North American Review* for March an article explaining his new system, recently illustrated and described by us, of telegraphing to and from moving trains.

Train Telegraphy.—A dispatch of March 5 from Chicago says than on train No. 9 of the Chicago, Milwaukee & St. Paul Road, leaving Chicago for Milwaukee at 3 P. M. on the 4th, the first experiment was made with the Edison system in the way of receiving messages on a regular express train in rapid motion from the various stations along the line of road. George C. McGregor, Manager of the Railway Telegraph and Telephone Company, supervised the work, which was performed by Messrs. Dingle and Rudd, electricians of the company. Communication was kept up with all the stations on the line as easily as if a wire had been stretched direct from the train.

A Pender Cable Contract.—In the English House of Commons on March 5, an adjourned debate on the "Post-Office submarine telegraph contract from St. Vincent to the West Coast of Africa" was resumed. On the question being put that the contract dated the 19th day of January, 1886, for the construction of a submarine telegraph line from the island of St. Vincent to the West Coast of Africa be approved, Mr. John Henniker Heaton said he rose to oppose the motion and to move as an amendment that the whole question should be referred to a select committee of the House. He then made a very sharp attack on Mr. John Pender as "a gentleman who was always looked upon with suspicion," but the original motion was carried.

Pacific Railroad Telegraph Systems.—The investigation ordered by the House into the alleged violation of law by the Pacific railroads in not maintaining its own telegraph system will begin on Tuesday next before the Post-office Committee. There is now pending before this committee a bill requiring the subsidy railroads to transmit all messages without discrimination of any kind. Now the Western Union controls the Pacific routes and will only send the messages of competing companies at discriminating rates. This, says Mr. Anderson, of Kansas, who introduced the bill, is a plain violation of law, and the Baltimore & Ohio Telegraph Company, through its president and other officials, will show the investigating committee evidence sustaining Congressman Anderson's allegations.

Tracing Receivers' Certificates.—James G. Smith, at one time co-Receiver, with Richard S. Newcombe, of the Bankers and Merchants' Telegraph Company, appeared before Referee Charles Henry Phelps March 6, in the suit brought by the Farmers' Loan and Trust Company to test the validity of the certificates issued by Receivers Smith and Newcombe in the early part of 1885. The hearing was held in Mr. Phelps' office, in the Mills Building. Mr. Smith testified that some of the certificates in question were issued to Alfred Sully and W. S. Myton on Jan. 30, 1885, under an order of the court, and in consideration of the surrender by Sully and Myton of claims held against the Bankers and Merchants' Company, and of certain stocks and bonds held as collateral security for such claims. The total issue of certificates by Receivers Smith and Newcombe was $600,000, but only a portion of them went to Messrs. Sully and Myton.

A Baltimore & Ohio Move.—Notice was published on March 4, at Huntingdon, Pa., and in many other counties of the State that an application will be made to the Governor on April 15 for a charter which it is believed is to cover an extensive scheme of operations. The name of the proposed corporation is the Baltimore & Ohio Telegraph Company, of Pennsylvania. The applicants for the charter are Frank W. Griffin, Joseph R. Kenney, Jacob S. W. Phillips, David H. Bates and Charles Selden, and the notice is signed by their solicitor in Philadelphia. The character and objects of the company are the constructing, maintaining and leasing lines of telegraph for the private use of individuals, firms and corporations, municipal or otherwise; for general and messenger business; for police and fire alarm, and for the transaction of any business in which electricity over or through wires may be applied to any useful purpose. The last stated object covers the telephone and electric light, and it is understood that the new company will enter into a rivalry with all others in these as well as in the business of establishing telegraph lines. It is claimed that under a charter such as is to be applied for the company may go into any town or city in the State and put up its poles, wires, and other machinery for lighting and other purposes, even in competition with incorporated local companies, and it is asserted that the practical carrying out of the scheme means a monopoly of the business of furnishing electricity for all the purposes to which it may be applied.

THE TELEPHONE.

The American National.—The American National Telephone Company, New York and Philadelphia, Pa., has been incorporated with a capital stock of $5,000,000. Levi S. Tenney, 21 Nassau street, and others, incorporators.

The Pan-Electric Investigating Committee.—The committee appointed by the Speaker of the House of Representatives is as follows: Democrats—Boyle, of Pennsylvania; Oates, of Alabama; Eden, of Illinois; Hale, of Missouri, and Hall, of Iowa. Republicans—Ranney, of Massachusetts; Millard, of New York; Hanback, of Kansas, and Moffatt, of Michigan.

The Patent Suit Bill Ready.—A dispatch from Washington of March 7 says: The bill prepared by the Government counsel to test the validity of the Bell Telephone patents is said to be completed. While nothing official can yet be obtained on the subject, it is the general belief that Columbus, Ohio, will be decided upon as the most appropriate city in which to try the case.

A Large Mortgage.—The New York & New Jersey Telephone Company filed a mortgage on March 2 in the Register's office, Brooklyn, on their entire property for $600,000, to Henry S. Hyde, of Springfield, Mass., and Burton V. Harrison, of New York, as trustees, to secure the payment of bonds which have been issued for the same amount. The mortgage is signed by Charles F. Cutler as President, and Joel C. Clark as Secretary.

Public Interest.—The select committee of the House of Representatives to investigate the telephone matter is having some difficulty in getting a room large enough for its sessions. As they are to be public, it is expected that there will be unusual interest on the part of many persons

to hear the daily proceedings. While there are plenty of large rooms they are all occupied by standing committees, and are in daily use by the full or sub-committees. Chairman Boyle hopes to be ready some time this week.

Regulating Rentals.—In the House of Representatives a bill has been introduced to regulate the monthly charges of the telephone company in the District of Columbia. It is substantially the same as the one now in force in Indiana, which the Supreme Court of that State recently decided was constitutional. Congress having the right to legislate for the District and the territories the proposed measure is regarded as perfectly "just." In the New York State Legislature another bill has been offered fixing rentals at $5 per month.

New York & Pennsylvania Company.—The annual meeting of the New York & Pennsylvania Telephone and Telegraph Company was held at the offices, 15 Cortlandt street, this city, on March 3. The following officers were elected: President, C. F. Cutler: Vice-President, H. L. Storke; Secretary and Treasurer, Joel C. Clark, who are directors with W. N. Eastabrook, General Manager, Chas. A. Nichols, C. R. Truex and R. S. Boyd. The company has 306 toll stations, and 2,194 other stations. It added 248 miles of pole line in 1885, and 431¼ miles of wire.

A Telephone Franchise Revoked.—The City Council of Hannibal, Mo., on March 2 repealed the ordinance granting the Missouri & Kansas Telephone Company a franchise to use the streets and alleys over which to run its wires. A contract is in existence which says that the company should charge only $3 per month for each instrument when the number of subscribers reached 100. Notwithstanding this, the company has been charging $4. The City Council made the demand several weeks ago that the rate be reduced to what is claimed to be the contract price. This the company refused to do, and hence the action of the Council.

A Telemicrophone.—M. Mercadier, the well-known French experimenter, has devised an apparatus which he calls a telemicrophone, and which is in reality a combined magneto-telephone and a carbon microphone transmitter. The microphone is so fixed to the iron telephone plate that the magneto currents produced by speaking to the plate are superposed upon the microphonic currents, which are also due to the vibrations of the plate. The double effect is thus obtainable at will; and the apparatus acts both as a transmitter and receiver. M. Mercadier has also fitted his apparatus with acoustical tubes which convey the sound to and from it without the necessity of putting the apparatus to the ear or mouth.

Poles a Necessity.—The Supreme Court of Missouri has rendered an opinion in the case of the Julia Building Association against the Bell Telephone Company. The case came before the Supreme Court on an appeal from the judgment of the St. Louis Court of Appeals. The Bell Telephone Company, in erecting poles on Sixth street, opposite a dry goods store owned by plaintiff, cut through a stone pavement and removed a portion of the masonry that forms the wall of the building. This the Julia Building Association claimed would result in great injury. The opinion is to the effect that telephone poles are a necessity, and when a company secures from the State and city the right to erect them, citizens owning property adjacent to the street cannot prevent it.

Kansas City.—The table below of the number of subscribers to the various telephone exchanges and daily calls in some of the largest cities of the country, is a slight indication of the amount of business being transacted daily in Kansas City over and above that of cities of much larger size:

	Subscribers.	Calls per day.
New York	5,252	36,153
Chicago	3,630	31,368
Kansas City	1,254	21,820
Detroit	1,956	20,800
Cleveland	1,620	16,213
Cincinnati	2,535	16,000
Philadelphia	2,310	15,136
St. Louis	1,528	9,168
Milwaukee	1,375	4,461

It will be seen that the average number of calls per day from each subscriber to the Kansas City exchange is 17, the largest average in the United States.

THE ELECTRIC LIGHT.

Rich Hill, Mo., is hankering after an electric light plant.

The Lafayette, Ind., Gas Company will be ready this spring to do an electric lighting business.

Raleigh, N. C.—This city is to be lighted by the Thomson-Houston system, with a Westinghouse engine.

Dixon, Ill.—The Dixon, Ill., Gas Light Company has changed its name to the Dixon Gas and Electric Light Company.

The Manhattan Electric Company, of this city, with a capital stock of $250,000, has been incorporated by W. G. Spiegel and others.

To Light the New York Elevated Roads.—It is understood that Mr. Cyrus Field is pushing a system to light the elevated trains by electricity.

Troy, N. Y.—Aldermen Scott, Gilbert and Wallace, of the Common Council, have been intrusted with the negotiations for 250 more lights for the city.

A Good Beginning.—A new suburb of Brooklyn is being formed, known as Ocean Parkway, and negotiations are now pending to light the entire Parkway by electricity.

Electric Light and Heat.—The Freese Electric Light and Heat Company, of Camden, N. J., has been incorporated by W. G. Hunter and others with a capital stock of $500,000.

Westinghouse Plants.—During the last sixty days the Westinghouse Electric Company have made installations of between 7,000 and 8,000 incandescent lamps, a few of the lights being of 150 candle-power.

Asheville, N. C.—The contract for lighting this city will be open until April 1. The population is 6,000, and the lighting area is about 1½ miles square. The committee in charge are G. W. Scott, N. W. Girwood and A. Rankin.

Knowing a Good Thing.—The Waterbury Electric Light Company, Waterbury, Conn., has ordered a 60 horse-power Armington & Sims engine from the Jarvis Engineering Company, making the third engine of this make it has purchased.

Better Times in England.—The directors of the Maxim-Weston Electric Company have recommended a 7½ per cent dividend, have passed $18,000 to the reserve account, and are about to increase their factory room, owing to the brisker demand for electric lighting.

To Give Experts a "Show."—A member of the Detroit City Council has proposed a plan which provides that the city shall have experts in electric, gas and naphtha lighting, who, in conjunction with the city comptroller, shall draw up plans and specifications of what will best light the city. All bids for lighting are to be made in conformity with these plans.

Milwaukee, Wis.—The Mayor has approved the bond of the Badger electric light company, of which Thomas R. Mercein, formerly connected with the exposition, is the manager. The new company will push the work of supplying electric lights at once. Plans for the company's building have already been prepared. The company will place a plant in the extensive works of E. P. Allis & Co., whereby the entire works will be illuminated.

Oskaloosa, Ia.—The Pond Engineering Company has contracted with the Oskaloosa (Ia.) Gas Light Company for the entire steam plant of their enlarged and remodeled electric light station. The order includes one 50 horse-power Armington & Sims automatic cut-off steam engine, two 50 horse-power steel boilers, two Jarvis boiler settings for same, two sets Sheffield grates, Korting injectors, etc. It is expected that the plant will be in operation early in April.

The Sperry System.—Mr. Elmer A. Sperry has improved his arc lights in a large hotel in this city (Chicago), by putting in new machinery. His agent in the west, Mr. F. O. Richards, has written a letter to the Mayor of Independence, Kan., that he is ready to visit that city with the Sperry light if twenty or twenty-five lights can be secured from private parties. The authorities of that enterprising city, on the principle, we presume, that "large bodies move slowly," are giving the matter of electric lighting a long consideration.—*Western Manufacturer.*

The National Capitol.—The Edison lights in the Capitol at Washington are giving great satisfaction. The chandelier recently placed in the Senate marble rooms, substituting the Edison lamps for gas jets, was lighted on March 6 for the first time. There are twenty-four burners encased in varied color glass representing tulips. The design of the chandelier is a massive basket of flowers and ferns. The Edison light is now exclusively used in the Senate wing, even the elevator being illuminated by an incandescent lamp. In the cloak rooms of the House and in the library under the gallery these lights are now being used with pleasure to all.

APPLICATIONS OF POWER.

Sewing Machines.—The Electric Sewing Machine Company, Chicago, Ill., has been incorporated with a capital stock of $100,000. James S. McKenney, box 274, Chicago, and others, incorporators.

As Omnipotent as a Trades Union.—The Otis Company, Ware, Mass., is putting a large electric clock into its office which is to give the signal for stopping and starting the wheels of the several mills, and also registers the rounds of the night watchman by means of buttons placed in the various rooms.

Favoring Electro-Motors.—After an examination of the electric motor in use on the line of street cars in Baltimore, the presidents of two St. Louis roads favor its substitution for horse-power. One of them reports that the success in Baltimore establishes electricity as the coming motor.

PERSONALS.

Sir Francis Bolton.—It is reported that this gentleman will visit America this year, to superintend personally the operation of his electric fountain at Staten Island.

Mr. J. Jepson, of the Norwich, Conn., Electric Light Company, has been compelled by ill health to resign his position and drop all work for a time. He is now rapidly recuperating.

Major James Biddle, U. S. Sixth Cavalry, has been assigned to duty at Fort Myer signal station as Commandant. It is said that the station will be conducted hereafter as a regular military post.

President Henry Morton, of the Stevens Institute of Technology, Hoboken, N, J, has been appointed to fill the vacancy in the Board of Trustees of that institution caused by the death of Wm. M. Shippen.

Mr. W. D. Sargent, the popular manager of the New York and New Jersey Telephone Company, left for Nassau, Bahamas, last week. He proposes to spend a month down there seeking health, amid the sunny sandbanks, pineapples and cocoanut trees.

Mr. W. E. Smith has resigned his position as Manager of the Allentown, Pa., Telephone Exchange and accepted a situation with Mr. S. M. Cortright, of Mauch Chunk, as private secretary and general traveling agent to represent him in the burglar and fire-alarm and telephone business. Mr. Smith has been connected with the telephone business several years and has given general satisfaction. Mr. Cortright has the general agency for the Pennsylvania Telephone Company.

Southern Homage to Edison.—Mr. Edison stopped at Atlanta the other day on his way to Florida with his bride. A gentleman unknown to him, the *Constitution* reports, walked up and tapping him familiarly on the shoulder with one hand extended the other. "You are the greatest man on earth," said the gentleman. "Thanks," said Mr. Edison, modestly. "Let me see your forehead, please." Mr. Edison pushed his hat back. "Take off your hat, please, won't you?" Mr. Edison removed his hat and stood bareheaded for fully a minute. "Thanks," said the stranger. "I have seen the greatest man the world ever produced. Shake hands with me once more and I'll go." Mr. Edison extended his hand, a pleasant smile was on his face, and as the stranger left, Mr. Edison sat down, struck a match and lighted his cigar. "That's a typical Southern man, ain't he?" asked Mr. Edison. "Why?" "Because he seems to be clever and polite." To all which the *Constitution*, not to be outdone, added editorially: "Atlanta is honored to-day by the presence of the greatest inventor the world has ever seen—Thomas A. Edison. He believes Atlanta to be a great city, which goes to prove that he is a man of unerring judgment."

MISCELLANEOUS NOTES.

Kind Words.—In quoting from a recent article in our columns, a leading Western paper, *The Age of Steel*, says: "THE ELECTRICAL WORLD is by all odds the best paper in this country devoted to electricity. It is progressive, enterprising and evidently very prosperous."

The Arcade Railway scheme for New York City is again before the State Legislature. The bill provides for the tunneling of the streets by a corporation, as a solution of the rapid transit problem. The company proposes to place beneath its tracks or alongside them the gas pipes, sewer pipes, steam pipes, and telegraph, telephone and electric light wires. The Commissioner of Public Works is to have supervision of the work.

Electric Gas Lighting.—Mr. A. L. Bogart has issued in circular form the decision of Judge Wallace in the United States Court for the Southern District of New York, in his suit against C. H. Hinds, for infringements of patents on improvements in apparatus for lighting gas jets by induced currents of electricity. Judge Wallace decrees under date of January 16 a perpetual writ of injunction against the defendant and an accounting.

Ozone Machines.—The court officers, clerks and other officials at the Tombs Court, this city, are congratulating themselves on their good fortune in at least obtaining proper ventilation. Three Hall ozone machines have been ordered by the Board of Police Justices, and they will soon be put in position. The stench of the court room has very often occasioned the magistrates to leave their desks and seek their private rooms, and it has very often too occasioned the illness of several gentlemen. The machines will be welcomed as a godsend, and ought to be far more generally introduced.

Amberina.—We have received from W. L. Libbey & Son a copy of the pamphlet containing the decision of Judge Colt, of the U. S. Circuit Court, given Feb. 17, 1886, granting a preliminary injunction against the Mount Washington Glass Co. and F. S. Shirley, for the infringement of the Libbey patent on the beautiful and popular Amberina glass. The firm have granted no licenses for making *blown* Amberina, but are the sole manufacturers in that line. The firm of Hobbs, Brockunier & Co. are the only licensees from the firm for making *pressed* Amberina.

Gas Engines.—The case of Otto *vs.* Sterne (L. Sterne & Co.), in England, which it was understood was settled previous to the trial of the action of Otto *vs.* Steel, was called up Feb. 1 in the High Court of Justice—Chancery Division—before Mr. Justice Pearson. The attorney for the plaintiff stated that the case had been standing out of the paper pending a settlement, and the parties had now arranged terms. The defendant, maker of the Clark gas engine in England, had agreed to submit to a perpetual injunction and to pay the costs; plaintiff on his part not pressing for any inquiry as to damages. The attorney for the defendant agreed to these terms, and the order was made accordingly.

Her Magnetic Corsets.—A young woman of Columbus, Ga., about to visit the station of the electric light company, was told to leave her watch at home lest it be magnetized by the strong electric current. She did so, but complained afterward that her watch would not keep good time. She sent it to a jeweler, but he reported that it was not magnetized, and kept good time. Still, whenever she carried it, her time was too slow, although when she left it in her room it ran correctly. A gentleman who knew of the circumstance suggested to the young lady that she wear another pair of corsets when next she carried the watch. She did so, and had no further trouble with the watch. The steel springs in her corsets had been magnetized.

Things of Beauty.—We never know when we are well off. We have been long looking upon the telegraph poles as an unsightly nuisance, when now comes Madame Greville and tells us point blank, "I think your telegraph poles give a much-wanted air of picturesqueness to the streets," and our amiable visitor expresses her sorrow that the wires are to go underground! Well, it has taken foreign eyes to see us in our true electric light. Madame Greville should know the precise meaning of the word "picturesque." But if she calls us picturesque under bare poles, so to say, what limit would there be to her artistic comments on our telegraph poles and our telegraph wires should she behold them incrusted with beautiful and iridescent crystals of ice?—*New York Tribune.*

New Forms of Thermopiles.—In a paper by H. Kayser, measurements are given of the electromotive force and resistances of various forms of thermopile, the source of heat being a gas flame burning a known number of litres of gas per hour. The electromotive force of a Noë-Rebicceck's thermo-electric pile of 20 elements was found to be constant for an indefinite length of time, provided that the external conditions, namely, gas pressure and temperature of the air, were unaltered; its electromotive force also exceeded that of a Bunsen element. The internal resistance increased to a maximum, with a consumption of gas from 0—60 litres per hour, and from that point to 110 litres per hour it diminished; the maximum resistance of a pile of 25 elements was 0.868 ohm. The relative advantages of a thermopile over a Bunsen element in cases of small external resistance are also discussed.—*Jour. Chem. Soc.*

An Important Engine Suit.—A suit has been commenced in the United States Circuit Court, Rochester, N. Y., involving the ownership and infringement of a patent of great value. The title of the action is the Shipman Engine Co. against the Rochester Machine Tool Co. The suit has been brought to restrain the defendant from using or infringing upon the patent of Albert H. Shipman, granted September 2, 1884, for an improved regulator for controlling the fire in engines. This is one of the well-known devices which has given the Shipman engines, now being used in small lighting plants, their reputation. It is an automatic safety arrangement which puts out the fire when the pressure gets too high. It is further claimed that the defendants are using several other patents controlled by plaintiff, and suits thereon will be at once commenced. Mr. George B. Selden, the attorney for the plaintiff, has also been instructed to bring actions against all purchasers of the defendant's engines.

Westinghouse Engines.—Among recent electric light customers, the Westinghouse Machine Co., of Pittsburgh, report: Portsmouth, Ohio, 60 horse-power; J. C. Reagan, Omaha, 60 horse-power (third order); Kuhn & Bro. and T. C. Jenkins, Pittsburgh, each 35 horse-power: Adams

Express Co., Philadelphia, 25 horse-power; Des Moines Electric Light Co., Moberly, Mo., four of 60 horse-power each; Moberly Electric Light Co., Moberly, Mo., two of 45 horse-power; Annheuser-Busch Brewing Co., St. Louis, Mo., 100 horse-power; Windsor Hotel, New York, 60 horse-power; Thomson-Houston Electric Light Co., Raleigh, N. C., 60 horse-power; Town of Union Silk Mill (second order), Union Hill, N. J., 60 horse-power; Allegheny Electric Light Co. (ninth and tenth orders), Pittsburgh, two 75 horse-power; Jas. Doak, Jr., & Co., Worsted Mills, Philadelphia, Pa., one 45 and one 15 horse-power.

SPARKS AND FLASHES.

Extremes Meet.—A man named *Freese* has formed a company for electric lighting and *heating*.

A New Condenser Wanted.—Telegraph Editor—The Pittsburgh *Bugle* wants Evarts's speech at the dinner to-night condensed to about 400 words. Night Editor (sarcastically)—Ask the *Bugle* if it thinks we keep on hand a patent double-million horse-power electric condensing machine for the accommodation of out-of-town papers.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 69½, a 69¾.

Telephone.—Am. Bell, b 155, a 156; Erie, b 26, a 27; New England, b 31½, a 32.

Electric Light.—Edison, b 150.

BUSINESS NOTICES.

Mr. George B. Grant, 66 Beverly street, Boston, has issued a catalogue that contains much valuable information on gear wheels and gear cutting. See advertisement on page viii.

Position Wanted.—A experienced manager of telephone exchange and electric light station advertises in our columns this week that he is now open for a new engagement. He is familiar with construction and with electrical goods generally. He is a good man to get hold of.

The Woodhouse & Rawson Electric Supply Company.—The supply department or merchants' business at 11 Queen Victoria street, London, E.C., of Messrs. Woodhouse & Rawson's electrical business, for the sale to merchants, shippers and the trade of all descriptions of electrical goods, was transferred on January 26 to the Woodhouse & Rawson Electrical Supply Company of Great Britain, Limited, with a registered capital of one hundred thousand pounds ($500,000). The management will continue to be under the personal supervision of Messrs. O. E. Woodhouse and F. L. Rawson, who will act as managing directors. We are requested to state that the above arrangement will not affect the business of Messrs. Woodhouse & Rawson, of 11 Queen Victoria street, London, E. C., who will continue to undertake electric light installations as heretofore, nor will it interfere with the business of the Woodhouse & Rawson Electric Manufacturing Company, Limited, of Cadby Hall Works, Kensington, who will continue the manufacture of electrical goods.

Notice of Removal.—C. E. Jones & Bro. have been remodeling for their factory, 55 and 57 Longworth street, Cincinnati, O., and in these new and commodious quarters they will be glad to see all old friends. They say: "We shall carry a larger and more complete assortment of stock of telegraph and electrical supplies than heretofore, and endeavor to have the latest and best. Having lost almost our entire stock of supplies in our recent fire, our new store will be stocked with new and fresh goods. In our manufacturing department, we suffered almost an entire loss of our tools, and serious damage to our machinery. In refitting and equipping this department we are negotiating for the most complete outfit of the very best tools and machinery on the market. We believe that the best tools and machinery are not only the cheapest in the end, but contribute vastly to the satisfaction of our customers, who patronize us in this department. Our facilities for making models, and doing experimental work, will be unexcelled."

An Eloquent Appeal.—The Jerome Kidder Company makes the following eloquent argument for electricity in medicine: The effort and desire of mankind is to obtain freedom from the ills of the flesh, and in their journey through this world to receive its benefits and enjoyments, and to avoid the aches and sufferings that seem to beset the way. How to do it, and do it effectually, is the inquiry, and to answer it step forward thousands with some panacea for general or special troubles that harass the individual. The sick and weary ones grasp at one and another in the hope of relief, sometimes attained, but oftener it is only an illusion. Would they know a means of relief for many and many an ailment of the flesh? It is found in the proper use of some of the forces of nature. These controlled, bring reviving strength, elasticity of body and mind, develop appetite, restore the functions of health, and the individual finds that old-time vigor and freshness that had seemed to have departed forever. No one force of nature has the same beneficent influence that has electricity, and the various devices of Jerome Kidder and his associates have turned this force of nature toward man's healing. Some have sought other ways of adapting it to usefulness, but this has been for man's direct benefit to personal happiness and to alleviate personal suffering. We therefore commend the Jerome Kidder Electrical Apparatus as the best of all the kinds that are manufactured to alleviate disease.

Dean's Rheumatic Pills
Are a sure cure, a superior remedy, almost infallible; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown, 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEBRUARY 23, 1886.

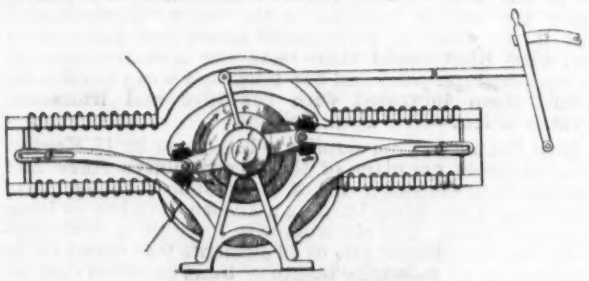
336,035, 336,036, 336,037. Electrical Devices; Jean M. A. G. Léscuyer, Paris, France. The first, an arc lamp, consists of one or more hollow differential solenoids, having movable soft-iron cores, which latter are connected by a horizontal plate. From this plate are suspended by pivot-links two inclined brake-rods, which are provided with beveled semicircular middle portions that extend around the upper-carbon holder and clasp the same. The lower ends of the brake-rods are provided with anti-friction rollers that form contact with a fixed stop-plate, so as to release the brake-rods.

The second relates to a dynamo armature seen in the cut, the coils of which are wound in a reverse direction to each other on the core, so as to form a central reversing pole or poles, and terminal poles the polarities of which are similar to each other but opposite to the polarity of the reversing pole or poles.

The third is an incandescent lamp and embraces a carbon filament for electric lamps, composed of two carbon pencils and a disc composed of a carbon ring having a filling of carbonaceous cement, through which latter the upper ends of the pencils pass.

336,562. Electric Signaling Apparatus; 356,563. Looping in Switch; Ezra T. Gilliland, Boston, Mass., Assignor to the American Bell Telephone Co., of same place. 1. Consists in an arrangement for stopping all the clock mechanisms at a given unison-point a number of times in each complete revolution of the train, thus insuring absolute harmony between the different instruments in circuit.

2. The arrangement is such that by the depression of



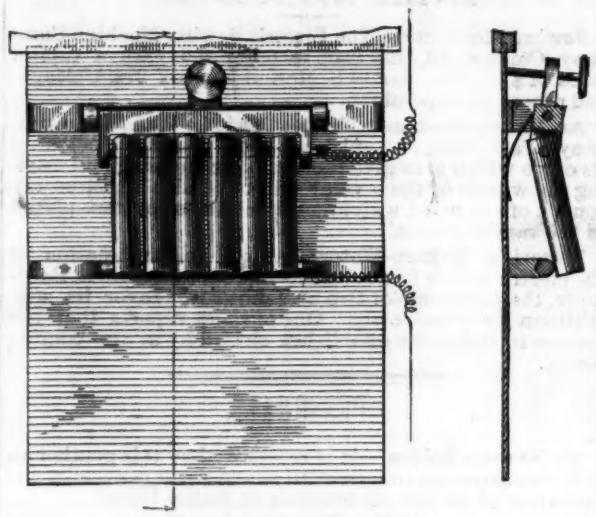
336,629. ELECTRIC MOTOR.

one of two buttons a listening-telephone may be introduced into a telephone-circuit; by the depression of the second button the said telephone is introduced into a second circuit; by the depression of both buttons simultaneously the telephone is looped into the circuit of two connected lines, and by imparting a rotary movement to a button a call is transmitted on one line or the other, depending upon which of the buttons is operated and upon the connection of the flexible conducting cords in the circuit of which the apparatus is normally included.

336,608. Regulator for Dynamo-Electric Machines; John E. Watson, Louisville, Ky. Consists in winding the field magnets first with coarse wire next the iron cores, then on the outside of the coarse wire winding a greater number of turns of fine wire. The coarse wire on the field magnets is all connected together in series, and connecting through the line, brush and armature back to the coarse wire of the field magnet cores, making the coarse wire of the field coils a part of the main or lamp circuit. The fine wire, however, is connected from the main line in a derived circuit, and each diagonally opposite pair of coils are connected together back through the current reversing mechanism to the negative wire of the main line or lamp circuit.

336,629. Electric Motor; Leo Daft, Greenville, N. J. As shown in the cut, it consists of a rocking lever having a pair of brushes at each end arranged with their inner ends projecting from each other, one of the brushes of each pair having a common terminal, and mechanism, whereby each diametrically-opposite pair may be brought into contact with the commutator at an angle to the direction of rotation of the commutator.

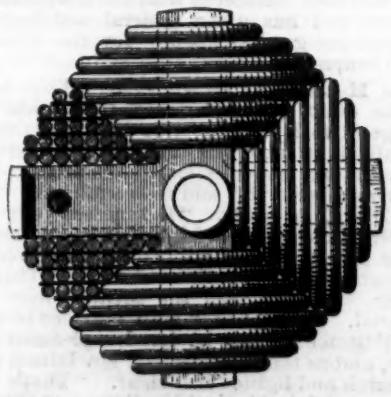
336,643. Electrical Call or Signaling Apparatus; 336,809. Electrical Communicator System for Hotels; Alfred G. Holcombe. 1. Consists of a call or signaling



336,876-7. TELEPHONE.

instrument embracing a signaling-disc actuated by a spring or other motor, provided with notches on its periphery arranged to indicate the calls or messages, and having a pointer or index secured to its shaft adapted to be set opposite the calls or signals marked on the case of the instrument, a spring pawl or dog carried by a pivoted arm arranged to catch into the teeth of and hold the signaling-disc when its attached pointer is set opposite any of the call-messages, a make-and-break contact-point carried by the pivoted arm, a lever arranged to lock the pivoted arm, a push-button for actuating the lever to release the pivoted arm, and a stop-pin projecting from the side of the signaling-disc, which, by coming in contact with the locking-lever, causes it to lock the pivoted arm when the disc has been rotated by its actuating-spring, and the pointer is at the zero mark. 2. Consists of a derived invention upon the first.

336,653. Convertible Telegraph Key; James A. Maloney and Andrew G. Johnson, Washington, D. C., said Johnson Assignor to said Maloney. As shown in the



336,036. DYNAMO ELECTRIC MACHINE.

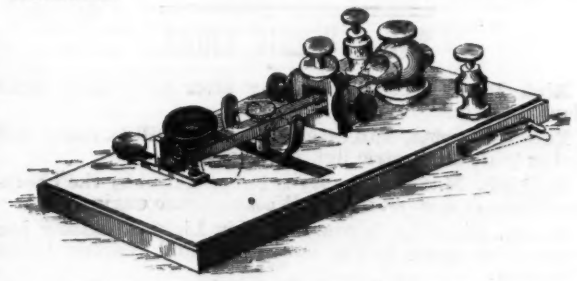
cut, it consists of a lever having a journal formed on one end, whereby it is adapted to revolve and to be operated vertically or horizontally.

336,688. Ammeter; John A. Barrett, Brooklyn, N. Y. Consists of the combination, with the disc, needle or other device movable under the influence of the electric current, of an arm or standard carrying a fan or vane, whereby prolonged vibration of the parts may be prevented.

336,716. Rheostat for Incandescent Electric Lights; S. Ambrose Hill, Sunbury, Pa., George Hill, Administrator of the former, deceased. Consists of a series of insulated wires secured on a drum or cylinder, which wires have bare parts, and have their ends connected by fine insulated wires, one of the said wires being connected with a binding-post. A contact-spring connected with another binding-post rests on the bare parts of the wires.

336,729. Incandescent Electric Lamp; William Main, Brooklyn, N. Y. Consists of a revolving disc set upon the axis of the lamp and intervening between the bottom of the lamp and the holder thereof, said disc being provided with suitable contacts and insulating section coacting in the circuit, said disc rotating independently of the lamp and the holder thereof, by which the current is turned in or out of the lamp by the rotation of said disc about its own axis and the axis of the lamp.

336,744. Telephone; Charles A. Randall, New York, N. Y. Consists of a main battery divided into sections, a series of independent battery-electrodes, one for each section of battery and connected thereto, and a diaphragm or vibrator carrying a single electrode common to all of the battery-electrodes and connected to the main-line wire, whereby the full effective working-current of the main battery as a whole may be passed to the main line through variable contact-electrodes without detrimental effects from the electric sparks at the electrodes.



336,653. CONVERTIBLE TELEGRAPH KEY.

336,773. Alarm for Detecting Water-Overflow; Leopold Weil, New York, N. Y. Embraces means for detecting the undesirable presence of water in a structure, and consists of electric conductors arranged in open circuit, and including a suitable alarm, which conductors are separated from one another by a material which will absorb water, and, when so moistened, will serve as a conductor between the aforementioned conductors to close the circuit and render it operative to sound the alarm.

336,780. Dynamo-Electric Machine; Royal E. Ball, New York, N. Y. Consists in providing a dynamo-electric machine with a revolving frame carrying the field-magnets, said frame being so constructed and arranged as to vary its position according to the magnetic attraction of the armature, and thus produce a compensating change in the relation to the poles of the collecting-brushes; also of a revolving frame carrying the field-magnets, commutator and collecting-brushes and intermediate connections, whereby any movement of the field-magnets will produce an actual compensating movement or adjustment of said brushes.

336,828. Insulator; Charles L. Travis, Minneapolis, Minn. A double ring hook, one end being buried in an insulating substance, which is hollowed out just above the other ring, forms a connection between cords and an arc lamp.

336,876, 336,877. Telephone; William C. Turnbull, Baltimore, Md. The nature and construction are clearly exhibited in the cut, which shows front and side views,